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FM 55-8

FIELD MANUAL

TRANSPORTATION INTELLIGENCE

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HEADQUARTERS, DEPARTMENT OF THE ARMY
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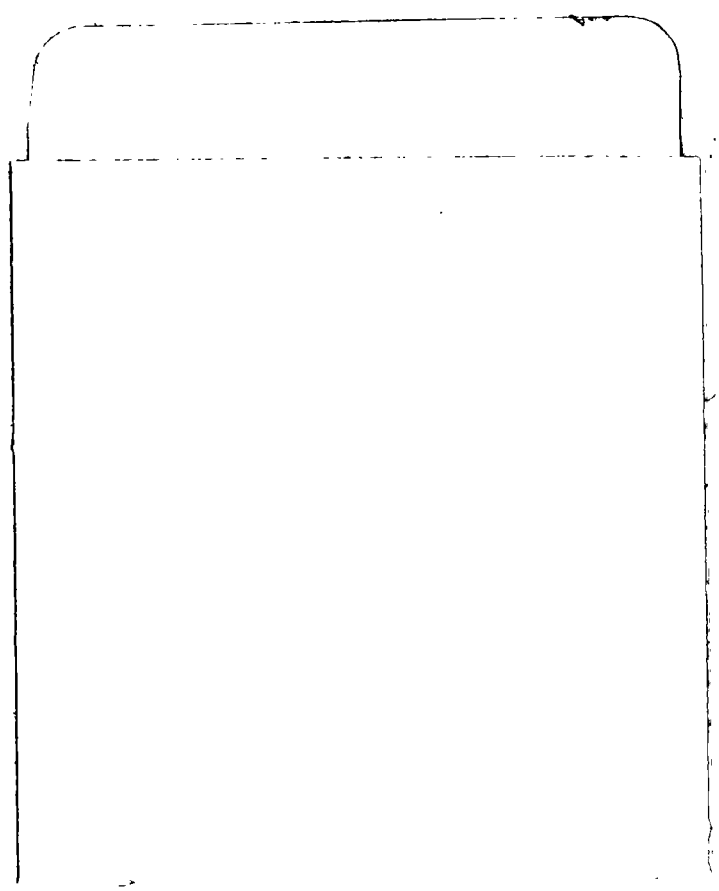

FIELD MANUAL
No. 55–8

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *12 March 1970*

TRANSPORTATION INTELLIGENCE

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CHAPTER 1

GENERAL

1–1. Purpose and Scope

a. This manual is a guide for personnel charged with responsibility for collecting and evaluating transportation intelligence and information. It may be used as a training and planning guide in the instruction of trainees in transportation technical intelligence activities.

b. Source references for transportation intelligence and related subjects are listed in appendix A. Information requirements and possible foreign sources of information for each mode of transportation are outlined in appendixes B through G. Appendix H consists of sample intelligence photographs, which show how transportation facilities and equipment should be photographed. Sample reporting formats are shown in appendix I. (FM 30–16 prescribes doctrine and the overall responsibilities and organization for the production of technical intelligence.)

1–2. Application

The material presented herein is applicable to both nuclear and nonnuclear warfare.

1–3. Changes and Revisions

Users of this field manual are encouraged to submit recommended changes or comments to improve the publication. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be prepared using DA Form 2028 (Recommended Changes to Publications) and forwarded direct to the Commandant, U.S. Army Transportation School, ATTN: AHBE–TS–DD, Fort Eustis, Virginia 23604.

CHAPTER 2

SOURCES AND SCOPE OF TRANSPORTATION INTELLIGENCE

2–1. Definitions and Employment of Intelligence

a. Intelligence (General). Intelligence is the product resulting from the collection, evaluation, analysis, integration, and interpretation of all available information which concerns one or more aspects of foreign nations or of areas of operations and that is immediately or potentially significant to military planning and operations.

b. Technical Intelligence. Technical intelligence is intelligence concerning foreign technological developments and operational capabilities of foreign materiel which have or may eventually have practical application to military requirements. It is the end product resulting from the processing and collation of technical information.

c. Transportation (Mobility) Intelligence. Transportation intelligence is a facet of technical intelligence. It is the product resulting from the collection, evaluation, interpretation, analysis, and integration of all available information about the air, land, and water transportation systems of foreign areas of operations that are of immediate or potential military significance. This intelligence includes data on the characteristics, condition, development, organization, materiel, operation, maintenance, and construction of transportation systems and facilities.

2–2. Scope of Transportation Information

a. Transportation and engineer intelligence frequently overlap; however, transportation planners are primarily concerned with the availability and capabilities of transportation facilities and equipment, whereas the engineer planners are primarily interested in the amount of rehabilitation effort required to restore transportation facilities to operating condition and the maintenance support required after restoration.

b. In the broad strategic sense, transportation information is data in any form (oral, written, or graphic) on—

(1) The terrain, including the location, identity, and physical description of natural and manmade features affecting the transportation system of a foreign country.

(2) Top transportation echelons of government, such as department of transportation, bureau of river and docks, Army headquarters, and other elements of defense having transportation responsibilities: information should include—

(*a*) Organization, strength and grades, and responsibility.

(*b*) Type of control and how accomplished.

(*c*) Extent of coordination with other government agencies.

(*d*) Chain of command through subordinate echelons.

(3) Organization, mission, functions, responsibilities, personnel and equipment strengths, and capabilities of transportation headquarters, units, and detachments at all levels.

(4) Training methods and programs, schools and other training facilities, tactical doctrines, and methods of procurement.

(5) Order of battle information of transportation forces.

(6) Mobilization systems and potential of civilian and quasi-military agencies, facilities, equipment, and personnel.

(7) The identity and accomplishments of outstanding civilians in the field of transportation.

(8) Design, manufacture (including capabilities of manufacturing agencies), mechanical functioning, military and civilian inventories, and maintenance of transportation equipment.

(9) System of maintenance, including methods of implementation, repair, evacuation, and replacement of equipment and the efficiency of systems and personnel.

c. For reference purposes, transportation information normally is categorized as follows:

(1) Airfields and heliports.

(2) Construction resources for transportation facilities.

(3) Electric power.

(4) Effect of climate, weather, and terrain on transportation.

(5) Highways, highway bridges, and ferries.

(6) Inland waterways.

(7) Pipelines and petroleum fuel resources.

(8) Ports, harbors, and water terminals.

(9) Railways and rail bridges.

(10) Solid fuels.

(11) State of ground and trafficability.

(12) Transportation operations.

(13) Transportation organization.

(14) Transportation training.

(15) Transportation "Who's Who" (specialists).

d. The information noted in *b* and *c* above is essential to organizational transportation elements and combat commanders planning military operations. Combat commanders normally rely on their staff transportation personnel for transportation intelligence.

e. Transportation intelligence has always been essential to successful military operations. Now, with the development of highly complex weapons systems and the necessity of rapidly deploying our troops to remote areas and then keeping them supplied, technical intelligence has assumed a more critical role in military planning.

f. The major objectives of transportation intelligence are to—

(1) Determine foreign transportation capabilities and limitations.

(2) Provide information from which military countermeasures are developed.

(3) Permit use of foreign transportation equipment and facilities by U.S. Forces.

(4) Exploit new transportation developments for U.S. Military needs.

(5) Provide input on a continuous basis to the overall national integrated technical and scientific intelligence program in consonance with theater policy.

(6) Provide tactical and strategic studies on characteristics, capabilities, and limitations of foreign transportation equipment, facilities, and installations.

CHAPTER 3

RESPONSIBILITIES

3–1. General

The collection of transportation information and the production and dissemination of transportation intelligence are command responsibilities. The transportation special staff officer, or transportation specialist, who assists the G4 in transportation matters provides technical guidance in the discharge of these responsibilities. At all echelons, the G2 (S2) is responsible for technical intelligence coordination and is the initial point of contact with non-Army agencies—civil, military, domestic, and foreign. In addition, he is responsible for integrating and coordinating the collection effort of all technical intelligence agencies within the command. Unnecessary duplication of effort will result unless coordination is effected between all concerned because other services, G2's of all commands, and other agencies also collect and report transportation information and/or intelligence.

3–2. Technical Intelligence Company

a. The technical intelligence company, organized under TOE 30–34, is responsible for the functionalized execution of technical intelligence within the field army. This grouping, in one company, of various technical skills provides a capability for a coordinated technical intelligence effort; provides an interchange of skills, knowledge, and experience; and the consolidation of specialized technical skills necessary to provide a widely varied functional technical intelligence support to the field army.

b. This unit is responsible for—

(1) Examination, evaluation, and classification of captured enemy materiel.

(2) Preparation and dissemination of technical intelligence reports, summaries, and analyses.

(3) Preparation and maintenance of technical intelligence files and records.

(4) Preparation of captured enemy material for evacuation to CONUS bases as required.

(5) Interrogation of prisoners-of-war for technical information and processing the information derived therefrom.

(6) Operation of a control center for a coordinated technical intelligence control center within the field army.

3–3. Staff Transportation Officer

The staff transportation officer, or transportation specialist on the G4 staff, uses transportation technical data and intelligence for his own military planning purposes and prepares special transportation intelligence studies, reports, and analyses for G2 use in estimating the effect of enemy transportation capacities and capabilities on both our own and enemy military operations. The transportation officer provides guidance in transportation intelligence training to command personnel. He is responsible for the prompt reporting and submitting of foreign transportation documents and captured transportation equipment which he gains possession of or of which he has knowledge. Information is forwarded to the staff intelligence officer without delay.

3–4. Other Transportation Personnel

All personnel are responsible for reporting promptly to their commander or section chief all information of intelligence value about the enemy, his strength, equipment, location, and movement. They are also responsible for safeguarding and turning in captured documents and equipment. Personnel in all headquarters and units must make a continuous effort to collect and to report all types of transportation information of potential intelligence value that can be collected within their area of operations.

3–5. Defense Intelligence Agency (DIA)

The Defense Intelligence Agency collects equipment; material data; and information concerning

transportation networks, organizations, and stockpiles on a continual basis. DIA also acts as the central military technical intelligence coordinating office.

3–6. Producers of Foreign Intelligence

The principal producers of foreign intelligence are—

a. Assistant Director for Scientific and Technical Intelligence of DIA (DIAST).

b. Foreign Science and Technology Center (FSTC).

c. Missile Intelligence Directorate (MID).

d. Scientific and Technical Center (STIC) of the Department of the Navy.

e. Foreign Technology Division (FTD) of the Air Force.

3–7. U.S. Army Materiel Command

The U.S. Army Materiel Command, through its subordinate agency known as the Foreign Science and Technology Center (FSTC), is responsible for providing U.S. strategic planners, the military research and development agencies, and the military technical and scientific effort with timely and appropriate technical intelligence concerning equipment characteristics and conceptual use of end items.

CHAPTER 4

INTELLIGENCE OPERATIONS

Section I. COORDINATION

4–1. General

Transportation intelligence activities at each level of command are coordinated by the G2 with appropriate agencies in accordance with doctrine and procedures prescribed in FM 30–16.

4–2. Coordination

Through coordination between all echelons, transportation intelligence is available to all levels of command. Maintenance of close, systematic, and continuous coordination by the individuals and activities listed below will help to establish the essential elements of information, eliminate duplication of effort, expedite collection and processing, and insure adequate dissemination of intelligence data.

a. Transportation plans officer, movements officer, and other elements of the transportation section or transportation elements of the G4 section.

b. Communications zone transportation headquarters activities and transportation operating units.

c. Other staff sections—particularly the engineer sections because of similar intelligence interests.

d. Military intelligence units at division, corps, and field army levels from which intelligence support (imagery interpreters, order of battle specialists, counterintelligence agents, interrogators of prisoners of war) may be obtained.

e. Intelligence elements of the Navy, Air Force, and allied forces through the Assistant Chief of Staff for Intelligence.

4–3. Observation by Transportation Personnel

Although most specific and precise information is obtained by trained observers and intelligence personnel, transportation personnel who are not specifically trained or assigned to intelligence activities are potential collection agents. For example, troops on a support mission can observe and report areas suitable for trailer transfer points, bivouac areas, and truck parks. They can report on the effect streams have on truck movements, the existence of tracks and trails that do not show on maps, the existence of bridges and fords not previously recorded, possible landing zones, and buildings and hardstands suitable for transportation operations.

Section II. DIRECTION OF COLLECTION EFFORT

4–4. General

Direction and supervision of the collection effort is the responsibility of the G2 at each level of command. Direction involves: determination of information requirements and establishment of priority of items of information required, check of information available from other offices and agencies, allocation of available collection effort after balancing requirements against capabilities, issuance of requests for and orders to collect required information, evaluation of collection reports, and issuance of new instructions to collecting agencies. Guidance must be provided collecting agencies on the specific transportation information needed, time limitations when applicable, priorities of requirements, and means by which agencies can improve their transportation information collection effort. Collection agencies should be advised of changed priorities and completion of specific requirements.

4–5. Determination of Requirements

a. Essential Elements of Information. The critical items of information or intelligence required by a commander at a particular time to enable him to make a decision with confidence are the essential elements of information (EEI). The primary purpose of collecting transportation information is to enable the commander to assess the effect on his mission of air, land, and water transportation systems in his area of interest. The EEI depends entirely upon the situation; designation of the EEI is the responsibility of the commander. He should state the EEI, specifying items with the highest priority in sufficient time for the collection agencies to perform their mission properly. If the EEI is not announced by the commander, the intelligence officer should develop his own EEI and submit it to the commander for his approval. At each echelon, the essential elements may include certain requirements of higher, lower, and adjacent echelons. Even though the primary mission of collection agencies is the satisfying of the EEI, they should also collect and report any additional information required.

b. Implementation and Guidance.

(1) *Transportation planning officer.* The transportation planning officer, in coordination with the intelligence officer, at each level of command assembles and determines priority of transportation information requirements of his area and subordinate headquarters, analyzes them, and incorporates them into his information requirements. He checks all sources of information and makes requests to available agencies. He evaluates reports and provides continuous guidance to agencies collecting transportation information.

(2) *Transportation personnel.* All transportation personnel should collect and report all types of information of intelligence value within their areas of operations (para 3.2–3.4). Appendixes B through G provide a guide for information requirements pertaining to aviation, inland waterways, motor transport, ports, beaches and landing areas, railways, and miscellaneous modes of transport.

c. Available Data. Specific guidance in the collection of transportation information and the production of intelligence may be found in the following media:

(1) *National Intelligence Surveys.* The transportation sections of these publications contain the available data on major transportation facilities and principal routes in foreign areas. Transportation information gaps and deficiencies are indicated. These publications are available at oversea theater and command headquarters to meet initial wartime and peacetime military transportation planning and operational needs. Transportation officers and unit commanders endeavor to supplement this initial intelligence.

(2) *Analyses of transportation plans, annexes, and special transportation capability studies.* These analyses prepared by transportation personnel at various levels of command furnish guidance for determining information requirements. During the preparation of these plans and studies, a listing of intelligence gaps and deficiencies is developed for submission to the intelligence officer who initiates appropriate collection effort.

Section III. COLLECTING AND REPORTING INFORMATION

4–6. General

Transportation information embraces all pertinent information about the various modes of transportation. Collection includes coverage of foreign areas that are under the control of our own, friendly, and hostile military forces that are of immediate or potential significance to planning. Complete comprehensive coverage is required. Collection continues in peacetime as well as in periods of hostility. Every effort must be made to collect, report, and compile all basic transportation information needed for present and future military planning. The collection scope includes manmade and natural features of an area of operations. Emphasis must be placed upon the factors that greatly affect the different modes of transportation. For example, in a heavily populated area, manmade factors may be important, whereas natural features may be of greater importance in arctic, desert, and jungle areas. The impact of CBR warfare may be an important consideration. The type of coverage required must be determined before preparing a collection plan.

4–7. Collection Plan

a. Formulation of the collection plan depends upon the situation and the time element involved. The plan must coincide with the commander's needs at a given time for a given period. The intelligence officer must always be guided by what his

commander needs to know, when he needs to know it, and what collection agencies can best provide the information. After the information requirements have been determined, the intelligence officer prepares a collection worksheet. The worksheet lists the essential elements of information and indications which by their existence or nonexistence provide an answer to the EEI and serve as a basis for orders and requests for information from collecting agencies. The worksheet is designed to insure the systematic exploitation of all available agencies, by all means, and within a specified time. In addition to the worksheet, the intelligence officer also maintains a workbook. The workbook may be prepared as an indexed pad or looseleaf notebook showing the unit, situation, period covered, transportation mission, area involved, essential elements of information, specified collecting agency or agencies, and instructions for reporting the information. Although there is no prescribed form for the workbook, index tabs are customarily labeled to correspond with the headings of the unit's intelligence summary or periodic intelligence reports. The unit's intelligence requirements determine the subject headings used on the workbook.

b. The essential elements of information should be as concise as possible. Obvious items should not be explained; items that are not obvious should be explained in sufficient detail for the collecting agency to clearly understand its mission.

4–8. Collection Agencies

Any individual or organization which collects or processes information, or both collects and processes information is a collection agency. In addition to the technical intelligence company (TOE 30–34), transportation units or personnel may be assigned special collection and reporting tasks. Various services, such as Naval Intelligence, Air Force Intelligence, and particularly the Engineers, collect information of value to the transportation planning officer.

4–9. Sources of Information

A source is a person, thing, action, or condition from which desired information originates. In general, sources listed in this paragraph are those used by personnel responsible for the collection of transportation information and include activities and persons that may also be collecting agencies. Foreign sources are contained in appendixes B through F by transportation modes. Principal general sources are:

a. Persons.

(1) Military and civilian personnel of the Army transportation service and related services of the Navy, Air Force, Marines, and Coast Guard.

(2) Military police personnel.

(3) Civil affairs personnel.

(4) Civil authorities and local civilians.

(5) Representatives of contracting and engineering firms, export-import firms, manufacturers, suppliers, airlines and steamship lines, public utilities, and other agencies concerned with transportation.

(6) Captured enemy personnel, deserters, defectors, repatriates, and refugees. For detailed procedures in handling and interrogating prisoners of war, refer to FM 19–40 and FM 30–15.

(7) G2 personnel.

(8) Employees of—

(*a*) Major oil companies.

(*b*) Tourist, statistical, and census bureaus.

(9) Civilian and governmental transportation officials.

b. Documents. This source consists of written, printed, engraved, and photographic material—such as: maps, sketches, orders, tactical and technical manuals, cryptographic material, insignia, letters, photographs, diaries, notebooks, logbooks, maintenance records, newspapers, service records, and commercial transportation magazines and periodicals. Bookstores, libraries, captured enemy headquarters, command posts, observation posts, personnel, and all types of cargo- and personnel-carrying vehicles are possible sources of documents. At least one copy, preferably two, of all basic documents, maps, and diagrams should be forwarded through intelligence channels to the appropriate transportation officer. Examples of documents of a general nature are:

(1) Charts, manuals, manning tables, tables of organization and equipment, and related publications that show organization, functions, and staffing of departments, agencies, and operating units.

(2) Training aids, field and technical manuals, courses of instruction, lesson plans, textbooks, and other military training material.

(3) Transportation research and development plans and progress reports, including reports on characteristics and capabilities of new equipment and facilities and current developmental trends.

(4) Technical and scientific publications, including reports, studies, and analyses dealing with transportation developments, operations, and problems.

(5) Terrain, geographic, economic, commercial, industrial, military, and similar studies that give details on transportation systems, routes, facilities, structures, and equipment.

(6) Handbooks and similar publications. For example: transportation equipment manufacturers' handbooks, maintenance and servicing manuals, equipment catalogs, parts and accessories lists, operating instructions, design specifications, construction standards, working drawings, blueprints, photographs, films, test reports, scale models, prototypes, production records and schedules, sales records, advertising brochures, engineering textbooks, and other material dealing with design and construction standards, equipment specifications, and operating and maintenance practices.

(7) Transportation activity plans, studies, reports—such as brochures of construction firms, transportation consultants, public utilities offices, defense agencies, public works departments, oil and mining companies, and similar agencies.

(8) Tourist and travel agency literature on transportation routes and facilities; namely, maps, charts, photographs, operating schedules, timetables, and similar publications.

(9) Governmental and commercial publications that contain transportation articles, operating statistics, engineering data, and photographs.

(10) Technical dictionaries, encyclopedias, textbooks, and modern reference works on transportation subjects.

(11) Manifests, track charts, station diagrams, route profiles, bridge and tunnel clearance diagrams, route logs, and equipment registers.

(12) Cargo and shipping documentation for al ltransport modes.

c. Transportation Materiel. Transportation equipment includes motor vehicles, trailers, containers, locomotives, railcars, airplanes, helicopters, materials handling equipment, vessels, cranes, and barges. The information obtained should include: model, type, date of issue, place of manufacture, condition, capabilities, and other characteristics that will assist in developing intelligence of tactical, technical, and strategic value.

d. Transportation Facilities. Information about air, inland waterway, motor transport, port, beach, landing area, railway, and miscellaneous transportation facilities must be exploited (apps A and B). Transportation facilities which are overrun during combat should be examined without delay and detailed reports furnished through support service and intelligence channels. Because of the collateral interests of the Army transportation service and other agencies, exploitation is more effective if made jointly.

e. Related Facilities, Equipment, and Conditions. Facilities, equipment, and conditions that affect transportation, such as communication systems, geography, hydrology, location of contaminated areas, and concealment constitute this source.

f. Air and Ground Reconnaissance and Photography. A chief source of information is the actual inspection of an area. Whenever possible, the information obtained should be clarified and supplemented by photographic coverage (para 4–16*c*).

g. Climate and Terrain. Soil trafficability, visibility, operation and maintenance of equipment, cover and concealment, routes of communication, and mobility of vehicles and personnel are affected by climate and terrain. Extreme conditions caused by mountains, desert, precipitation, wind, heat, and cold are of particular significance. See FM 30–5 for a detailed discussion of the effect of climate and terrain.

4–10. Methods of Collection

General methods of collecting transportation information of intelligence value are research and observation, interrogation of a source, and liaison with the other technical services and combat units.

a. Research and Observation. Transportation personnel must be alert constantly; they should observe and report everything of intelligence value. Personnel charged with information collection responsibilities make ground and air reconnaissance trips. Orders for these trips should specify the area to be reconnoitered, route(s) to be traveled, special features or structures to be observed, whether aerial photography is desired, and any other data desired and in what detail. Personnel must be trained to recognize and report on intercepted enemy communications, documents, maps, photographs, and materiel. Climatic data and the observation of enemy activity, or lack of it, may provide clues to vital information. Maximum use should be made of ground and aerial photography.

b. Interrogation. Enemy civilians and military personnel, including prisoners of war and desert-

ers, are the chief sources of information gained from interrogation. The techniques of interrogation are explained in FM 30–15.

c. Liaison with Other Military Units. Transportation personnel must take advantage of opportunities to obtain transportation information from combat units, other support services, civil affairs units, military police units, and Naval and Air Force intelligence elements. Trained transportation intelligence personnel and/or technically qualified specialists should be made available to the units with which liaison is necessary. Personnel should be assigned sufficiently in advance to be thoroughly briefed. Liaison with military units is necessary for both tactical and strategic planning.

(1) *Tactical planning.* This is normally accomplished through liaison with the units concerned. Combat units are usually the first to discover information that can be used in transportation tactical planning. Continuous liaison with combat units, civil affairs units, military police units, the other support services—particularly the combat engineers, and with supported or supporting Air Force and Navy elements is of prime importance. Accurate and current information will eliminate delays and duplication of effort, thus facilitating rapid formulation of transportation tactical plans.

(2) *Strategic planning.*

(*a*) Coordination with the same agencies shown in (1) above is also necessary for strategic planning and for research and development. The Corps of Engineers is the principal service with which the transportation personnel are concerned. Responsibility for production and maintenance of lines of communication intelligence rests jointly with these two support services.

(*b*) Transportation systems in the proposed area of operations must be evaluated. New construction of roads, bridges, railways, and water and air terminal facilities must be considered and planned. The impact on the land transportation system of Air Force and Navy requirements must also be considered well in advance. Finally, essential civilian use of lines of communication must be determined by intelligence activities before the actual outbreak of hostilities.

4–11. Collection in Arctic, Desert, and Jungle Areas

a. Arctic.

(1) *Winter operations.* In arctic and subarctic areas the enemy's movement capability is of primary importance. Personnel and equipment must be moved over snow and ice by either air or surface transportation. Surface movement usually is over roads, frozen waterways, or cross-country. The local situation determines the transportation mode—sled dogs and motor transport capability. Information must be obtained about—

(*a*) Type, quality, and quantity of enemy equipment, including skis, snowshoes, special purpose vehicles, snow removal equipment, sleds, winter clothing, mobile shelters, and animals.

(*b*) The most suitable mode of transport for the area under consideration (pack or draft animals, air, rail, motor transport).

(*c*) Effect of weather and terrain conditions upon each possible mode of transport, including the load-bearing capacity of surfaces.

(*d*) Number of personnel available and the extent of their training in the operation and maintenance of transportation equipment.

(*e*) Status of supplies required for movement (POL, repair parts, etc).

(*f*) Road and rail net available.

(*g*) Aviation facilities available, including aircraft by type, airfields, and helicopter landing sites (approaches, exits, obstacles, topography, location, concealment, takeoff and landing directions, and condition of surface).

(*h*) Ability of the enemy to navigate in the Arctic.

(*i*) Ports and beaches available, degree of usability, ability of the enemy to discharge and receive cargo at each, and adequacy of connecting interior lines of communication.

(*j*) Ability of the enemy to stage air-transported operations.

(*k*) Movement capability of the enemy by each mode of transport, including foot marches.

(*l*) Rail equipment available and its condition.

(2) *Summer operations.* In addition to the information described in (1) above that applies also to summer operations, information will be needed about—

(*a*) Bridging equipment, rafts, and boats available to the enemy.

(*b*) Tides and swiftness of currents in streams and rivers.

(*c*) Swamps, mud, dust, and rough, undeveloped roads; ability of the enemy to improve these conditions.

(*d*) Location, description, and characteristics of inland waterway network.

(*e*) Number and type of special purpose cross-country vehicles available to the enemy.

b. Desert. Securing information about the enemy's ability to move personnel and equipment under adverse conditions—rugged terrain, limited water supply, deep sand, windstorms, salt marshes, and extreme temperature ranges—is a chief objective of collection agencies. Although temperature above 130° F is common in the desert in the daytime, such a drop may occur in the night that heavy clothing and warm bedding are necessary. Usually, all the water needed for both men and machines has to be transported because sources are rare. Surface conditions and the lack of roads make special training in operating transport equipment mandatory. Information about the subjects listed below will help determine movement capability of the enemy.

(1) Type, quantity, and quality of transport equipment, including an evaluation of the capability of equipment to traverse rugged terrain and sand without overheating.

(2) Status of driver training, including ability to operate special traction equipment.

(3) Status of critical supplies required for movement, such as POL, water, and repair parts.

(4) Conduct of maintenance, including special provisions for avoiding excessive abrasive wear.

(5) Ability to navigate in the desert.

(6) Employment of aircraft.

c. Jungle. Human bearers, pack and draft animals, inland waterway craft, aircraft, and motor vehicles are the transportation media used in jungle operations. The particular nature of the area determines the medium. The principal modes of jungle transport are usually human bearers and pack animals. Inland waterways are used to the maximum extent possible, because this mode is economical and practical. Aircraft can be employed frequently. Parachute and free-fall supply techniques can be used when landing is not possible. The use of motor transport in jungles is limited—being used only where there are roads or where vegetation is not heavy. Small wheeled-vehicles and trailers, and small tracked-vehicles can be used on trails; however, this usually requires the use of engineer troops. Transportation information for jungle operations should include—

(1) Availability and dependability of human bearers and of pack and draft animals.

(2) Availability and characteristics of inland waterways.

(3) Type, quantity, and quality of aircraft and inland waterway craft.

(4) Motor transport availability and suitability for employment.

(5) Nature of the terrain, including amount and quality of vegetation.

(6) Enemy transportation personnel, including pioneer troops.

(7) Effect of deterioration upon supplies, such as rations, forage for animals, POL, and repair parts. (It should be borne in mind that jungle vegetation is normally not suitable food for domesticated animals. Food for such animals must be carried.)

(8) General transportation capability analyses for both dry and wet seasons.

(9) Ability of the enemy to maneuver in jungles.

4–12. Estimating the Effect of Enemy Nuclear, Biological and Chemical (NBC) Operations on Transportation Capability

Although the collection of NBC information is primarily a function of the chemical officer at each level of command, the transportation officer, through liaison with the chemical officer, must assess the presumptive impact of NBC operations on transport capability. Before a nuclear or NBC attack, data must be evaluated to estimate the probable effect on transport capability. After an attack, the damage to personnel, facilities, and equipment must be determined. Generalizations about these operations and assessing the resulting damage are discussed below.

a. Enemy Nuclear, Biological and Chemical Operations (NBC).

(1) *Nuclear warfare.* Nuclear warfare may cause mass destruction and radioactive contamination. Nuclear weapons can be employed against personnel, equipment, supplies, and facilities and are especially effective when used against advanced civilizations. The scale of nuclear warfare determines the type and degree of protection required for adequate security of units and installations. Knowledge of enemy nuclear capabilities permits the commander to judge the degree of vulnerability a command can accept in accomplishing a mission. This knowledge can be the deciding

factor in selecting a course of action and in locating units and facilities.

(*a*) Limited use of nuclear weapons dictates that forces adopt measures which permit speed, dispersion, and a high degree of air and ground mobility. Information concerning routes available to the enemy assists in determining enemy capabilities and vulnerabilities and courses of action for our own forces.

(*b*) Unlimited nuclear warfare further increases the importance of ground and air mobility. It increases reliance upon flexible modes of transport, such as major ports, main rail lines, and large transportation centers. It also increases the importance of counterintelligence, reconnaissance, surveillance, target acquisition, dispersion, and communications. A command must be dispersed so as not to expose disproportionate parts to destruction.

(*c*) Employment of nuclear weapons on any scale requires that maximum advantage be taken of terrain configuration if the transportation mission makes this possible. The effects of heat and blast in particular are greatly minimized when deflected by irregularities in the terrain. For example, routes of communication located in gorges, steep valleys, or in mountainous areas present less favorable nuclear targets than routes located on flat terrain if the axis of the valley or ravine points well away from ground zero. If the axis of the valley points toward ground zero, there is little or no shielding effect and blast damage may be increased because of channelizing the blast wave. Furthermore, such routes as these may be blocked by obstacles and induced radiation patterns that cannot be circumvented.

(2) *Toxic agents and living organisms.* Enemy chemical and biological agents can completely destroy transport capability by rendering ineffective the required number of personnel and animals. They can be used either directly or indirectly against personnel. They can be used indirectly by contaminating crops, water supplies, and equipment. These agents may be employed for either tactical or strategic reasons. Particularly in backward areas of the world where decontamination procedures, sanitation facilities, and medical supplies are lacking, chemical and biological weapons could be decisive by destroying vast segments of the population.

(3) *Dispersion.* Because of the potential of nuclear and chemical weapons, large concentrations of personnel offer the most profitable targets. Consequently, commanders will probably disperse both personnel and equipment to the maximum extent possible. For example, miniaturization of equipment and use of automatic data processing systems make it possible to disperse depots, supply points, and collecting areas.

(4) *Flexible supply system.* Dispersion of personnel and equipment necessitates the use of a flexible supply system. Commanders may be expected to employ a system of mobile replenishment: large quantities of materiel will not be stockpiled. Underground shelters will probably be used to avoid nuclear and chemical hazards.

b. Assessing Damage. General, tactical, and strategic assessment of damage is necessary after an NBC attack.

(1) *General.* After an attack, it is of paramount importance to determine the enemy's ability to recover. The degree to which his transportation system has been destroyed—including personnel, equipment, and facilities—must be assessed without delay. It is of equal importance to estimate his ability to replace personnel and equipment, to employ reserve supplies, to repair or rebuild facilities, and to make use of such recovery methods as rescheduling, rerouting, and decontamination. In addition to assessing the enemy's ability to recover, the possibility of our own forces using the area must also be determined. Information is needed about the time involved before our own forces can enter the area because of residual radiation or chemical contamination; the extent of destruction of transportation facilities for all modes of transportation and the repairs required; the radioactive or chemical contamination of transportation facilities in the area; and the decontamination and individual protective measures required.

(2) *Tactical.* When assessing tactical damage, it is almost always desirable to base the analysis on casualties rather than on damage to materiel, with the exception of bridges and key structures. If transportation has been immobilized because of casualties that are not readily replaceable, sufficient effect has been obtained. Casualties from enemy chemical and biological weapons will depend primarily upon the availability and use of protective masks, cover, medical supplies, and immunizations. Important considerations in the assessment of casualties from NBC weapons are—

(*a*) *Temperature.*

1. Nuclear attacks delivered during extremely low temperatures normally result in

fewer casualties because of the tendency of personnel to seek shelter from the weather.

2. Low temperature reduces flash burns and the effects of thermal radiation because of the heavy clothing worn.

(*b*) *Haze, mist, and fog.* These atmospheric conditions reduce the thermal radiation and flash effects of nuclear explosions, but tent to increase radioactive contamination.

(*c*) *Rainfall.* Rainfall reduces the effects of thermal radiation by raising the ignition point of personnel and objects. It can also wash a certain amount of chemical, biological, and radioactive contamination from personnel, equipment, and facilities, but in turn produces greater contamination of drainage systems and low areas.

(*d*) *Wind.* Wind direction and velocity do not greatly affect blast, thermal radiation, and initial nuclear radiation; they do affect residual radiation caused by fallout and the distribution of chemical and biological agents.

(*e*) *Terrain.*

1. Ravines, deep valleys, and mountainous terrain in general greatly reduce personnel casualties from blast, flash burns, and initial nuclear radiation.

2. Forests or heavily wooded areas minimize the effects of thermal radiation; however, the resulting hazard of forest fires and falling limbs and trees is great. Fallen trees and the induced radiation pattern may increase the number of casualties and restrict use of the area.

(*f*) *Built-up areas.*

1. Built-up areas shield personnel from heat, radiation, and moderate blast; severe blast increases the hazard in these areas because of falling debris.

2. Personnel protected by well-prepared and deeply dug fortifications experience relatively few casualties from nuclear bursts.

(*g*) *Enemy training status.* The number of casualties is affected by the enemy's nuclear and chemical warfare training, particularly his detection and identification capabilities.

(3) *Strategic.* Damage assessment in the strategic sense is based primarily on the enemy's war-making potential. This includes evaluation of damage to structures, factories, transportation systems, crops, and natural resources. Strategic damage assessment is made by theater special damage assessment teams; these teams obtain technical information and increase our knowledge of nuclear and chemical weapons effects.

c. Commander's Evaluation. After considering the factors discussed in *a* and *b* above, the commander must evaluate transportation capability before and after a nuclear or NBC attack. Evaluation must be continuous and must keep pace with changing situations; it must include estimating both enemy and friendly force capability in the specified area.

4–13. Determining Enemy Capability To Transport Missiles and Nuclear Weapons

The enemy's missile and nuclear weapon transport capability is a primary concern of the transportation planner. The sizes and weights of missiles and their component systems, the special problems involved in transporting fuel and oxidizers, and the characteristics of the enemy's transportation modes must be considered when collecting information. The topics listed below may be used as a collection guide.

a. General.

(1) Transport responsibilities of individuals, units, staffs, and agencies.

(2) Safety regulations in effect or lacking.

(3) Methods of transporting classified shipments.

(4) Labels, seals, and placards in use.

(5) Missile description (operational and in research and development).

(*a*) Nomenclature, model, and type.

(*b*) Classification.

1. Use and range (surface-to-surface, surface-to-air, etc).

2. Purpose and employment.

3. Propulsion and guidance systems: rocket engine, booster engine, guidance system.

(*c*) Characteristics.

1. Missile components (explosive, nonexplosive) and containers.

2. Propellants (liquid and solid) and containers.

(6) Tactical organization.

(*a*) Command organizational structure.

(*b*) Deployment.

1. Mobile.

2. Fixed: missile launching sites, assembly or recycling areas, storage areas, depots, or area defense complexes.

(*c*) Movement. This refers to the normal

modes of transportation and includes types of equipment used in administrative and tactical movements for initial deployment and resupplying of missiles and supporting equipment.

b. Sizes and Weights of Transportable Items. The sizes and weights of the items listed below should be obtained. Whenever possible, diagrams of shipping containers should also be procured.

(1) Delivery vehicle (shell, motor) and integral propellants.

(2) Warhead and adaptation kits.

(3) Propellant containers if not an integral part of the delivery vehicle.

(4) Ground support equipment.

(*a*) Transporting, erecting, and launching.

(*b*) Ground guidance and antenna.

(*c*) Testing and maintenance.

(*d*) Propellant manufacturing and storage.

(*e*) Auxiliary: compressor and power generating, assembling and fueling.

c. Enemy Capability of Handling Shipping Problems. The enmy's capability to transport oxidizers, such as hydrogen peroxide and liquid oxygen; radioactive materials; conventional explosives; radioactive materials with conventional explosives; deadly unstable material, such as plutonium; solid and liquid fuels; and all flammable liquids that present shipping problems must be assessed. Special consideration must be given to—

(1) *Movements limitations.*

(*a*) Dimensions and configuration.

(*b*) Weight and center of gravity.

(*c*) Other limitations, such as stability, speed, gradeability, braking, turning radius of vehicles, including tractor-semitrailer combinations.

(2) *Sensitivity.*

(*a*) Shock and vibration.

(*b*) Temperature and humidity.

(*c*) Evaporation.

(3) *Hazards and countermeasures.*

(*a*) Detonation or explosion.

(*b*) Flammability.

(*c*) Corrosion.

(*d*) Acid burns and toxic poisons.

(*e*) Chemical, biological, and radiological.

(*f*) Protective clothing and equipment.

(4) *Handling and intransit storage.*

(*a*) Proximity limitations that control quantity and distance.

(*b*) Surveillance restrictions and inspections.

(*c*) Decontamination and disposal.

(*d*) Security.

d. Methods of Shipment. The type and number, or quantity, of items to be shipped, characteristics, cargo dimensions, and number of carriers involved must be determined. Missiles and nuclear weapons are usually transported by—

(1) *Rail.*

(*a*) Conventional rolling equipment, such as boxcars, flatcars, and tank cars.

(*b*) Special purpose rail equipment.

(2) *Motor transport.* Commercial and military motor vehicles—conventional and special purpose.

(3) *Water carriers.* Commercial and military.

(4) *Aircraft.* Commercial and military.

4–14. Determining Enemy Transportation Order of Battle

Order of battle is the manner in which transportation forces are organized, disposed, maneuvered, and supplied. Intelligence concerning these forces consists of processed information about their composition, disposition, strength, training, tactics, logistics, and efficiency. Particular areas of interest in the collection of order of battle information are outlined below. See FM 30–16 for detailed discussion of order of battle intelligence.

a. General Information on Ground Forces and Army Air Transportation.

(1) Strengths, weaknesses, and trends (short and long range).

(2) Significant foreign influences.

(*a*) Advisory groups.

(*b*) Sources of military aid.

b. Administrative Organization.

(1) Army high command.

(*a*) Departmental or ministerial organization.

(*b*) Overall transportation organizations.

(*c*) Chain of command through territorial headquarters and field forces.

(*d*) Organizational charts of high command transportation and transportation support sections.

(*e*) Proposed changes in the event of war.

(2) Functions, including internal organiza-

tion of each transportation bureau and staff division.

(3) Arms and services, including status, concept, and functions of transportation service.

c. Tactical Organization and Location of Transportation Service Units.

(1) Tables of organization for all modes.

(2) Implementation of tables of organization, personnel, and equipment.

(3) Mission, capability, and normal assignment.

(4) Location.

d. Strategy and Defenses.

(1) Permanent fortifications within transportation installations.

(2) Fortifications for any transportation facility with a potential military use.

e. Training and Tactics.

(1) Quality and effectiveness of transportation training system.

(2) Strengths, weaknesses, and current trends.

(3) Influence of foreign military missions.

(4) Tactical doctrine for transportation operations.

(5) Types of units, training, and equipment for special transportation operations.

(6) Individual training.

(*a*) Basic, advanced, and specialized training courses for officer and enlisted transportation personnel.

(*b*) Organization and function of transportation training installations.

(*c*) Replacement training system in wartime.

(*d*) Transportation training in schools of allied countries (student exchange program).

(7) Unit training.

(*a*) Systems employed and effectiveness.

(*b*) Number and type of units involved.

f. Logistics.

(1) Classification of transportation equipment and supplies.

(2) Procurement.

(*a*) Planning and control.

(*b*) Design, placement of orders, acceptance, and testing.

(*c*) Role of other governmental agencies.

(*d*) Amount produced domestically by private industry and government arsenals, and amount imported.

(3) Peacetime storage and issue.

(*a*) System of storage and issue in zone of interior.

(*b*) Installations, depots, and other storage installations.

(4) Wartime supply and movement.

(*a*) Requisition and supply in time of war.

(*b*) Efficiency of system.

(*c*) All transportation organization responsibilities and functions in army, unit movement and resupply requirements.

(*d*) Military use of civilian transport.

(5) Echelons of maintenance and repair.

(6) Evacuation.

(*a*) Transportation equipment and personnel.

(*b*) Captured material and prisoners of war.

(7) Transportation materiel.

(a) Quality and quantity.

(*b*) Existing condition and efficiency.

g. Personalities. Biographical data on key transportation personalities: name, rank, age, and present position.

h. Quasi-Military Forces.

(1) Transportation organizations receiving military training as preparation for wartime military service.

(2) Transportation organizations within military forces used for security or border guard work.

4–15. Evaluating Political, Economic and Scientific Aspects of Enemy Transportation System

a. The political situation vitally affects national unity and defense and must be considered when evaluating the enemy's overall transport capability. Decisions that immediately affect national defense can be made in countries that have centralized governments. The transportation intelligence officer should be informed about—

(1) Legislation.

(*a*) Current transportation codes.

(*b*) Budgetary provisions for transportation.

(*c*) Trends favoring one or more modes of transportation.

(*d*) Neglect of one or more modes of transportation.

(2) Attitude of national government on transport matters.

(*a*) Governmental control measures.

(*b*) Plans for improving transportation.

(*c*) Attitudes of political leaders toward transportation.

(3) Public interest in improved transportation.

(4) Political personalities favoring rapid expansion of transportation.

b. The status of transportation in the economy of a nation can be judged by the effectiveness of transportation systems, their history and development, plans for future development, importance of the various modes, and national needs. Economic information can be obtained by studying—

(1) Industrial supply for all modes of transportation.

(*a*) Sources of supply of aircraft, land vehicles, marine craft, equipment, supplies, raw materials.

1. Domestic production (adequacy and capacities).

2. Foreign sources of supply (agreements in force).

3. Government controls and operating agreements with industry.

4. Contracts, agreements, and labor relations within industry.

(*b*) Research and development (production techniques, industrial expansion, modification of product, efficiency).

(*c*) Brochures.

(2) Statistical transportation information.

(*a*) Transportation factors influencing industrial production.

(*b*) Extent of government subsidization of privately owned common carriers.

(*c*) General reports of transportation associations and companies.

(*d*) Self-sufficiency of government-owned transportation.

(*e*) International organizations' reports reflecting conditions in the area.

1. United Nations Transportation and Communications Commission.

2. North Atlantic Treaty Organization.

(a) Planning Board for Ocean Shipping.

(b) Planning Board for European Inland Surface Transport.

(c) Planning Committee for International Civil Aviation Organization.

3. International Civil Aviation Organization.

4. Pan-American Railway Congress.

5. Pan-American Highway Congress.

6. United Nations Regional Commission.

(a) Economic Commission for Europe.

(b) Economic Commission for Latin America.

(c) Economic Commission for Asia and the Far East.

7. Southeast Asia Treaty Organization.

8. American-British-Canadian Agreements.

9. Organization of American States.

c. Information essential to the development of transport knowledge touches upon the entire scope of scientific and technical analysis, including both materiel and methods. This information can be obtained by studying—

(1) Aviation (Army aircraft, airfields, and heliports).

(2) Capabilities and capacities of equipment and transport facilities.

(3) Chemical, mechanical, and nuclear applications.

(4) Centers of gravity of equipment.

(5) Combat development (materiel and methods).

(6) Cost and efficiency studies.

(7) Engine and power train research and development.

(8) Energy (thermoelectric, thermochemical, and nuclear) conversion and storage.

(9) Hydraulics.

(10) Hydrology.

(11) Marine transport, including lighterage, amphibians and over-the-beach operations.

(12) Material handling devices.

(13) Missile transport by modes.

(14) Motor transport development.

(15) Physical forces: uses and applications.

(16) Pressure-volume-temperature ratios and applications of gases.

(17) Processing systems for data and their effects on dispersion of forces.

(18) Properties of materials (solid, liquid, gaseous) at different temperatures.

(19) Propulsion devices for water, air, and vacuum.

(20) Rail transportation facilities.

(21) Roll-on, roll-off cargo operations.

(22) Shock and vibration effects.

(24) Subsurface marine carriers and underwater storage.

(24) Surface-skimming craft and vehicles.

(25) Terminal layouts and facilities.

(26) Transportation communications.

(27) Transportation equipment research and development materiel, designs, and specifications.

(28) Vulnerability studies, including heat, blast, radiation, biological, and chemical effects.

4–16. Reporting

a. General. Reporting information is as important as collecting it. Data is of little or no value unless it is transmitted through proper channels so that appropriate action can be taken. Reports must be accurate, clear, concise, complete, and timely. Whenever practicable, they should include operational experience data. Applicable documents (para 4.9*b*) should be appended to each report if possible; if applicable documents are not appended, reference should be made in the report to their location and availability. In addition to a written or an oral report, maps, and photographs should be submitted when appropriate. If the time limit precludes the submission of a written report, an oral report may be submitted. A report may also be submitted piecemeal as the information is received. Normally, information is reported through specific staff and/or command channels. If it is necessary to act immediately on information obtained and at the level on which obtained, the report must include the action taken. The person submitting a report must be guided always by *what the commander needs to know and when he needs to know it.*

b. Maps. Maps may be attached to reports to show terrain conditions, communication routes, and trafficability. Adequate legends are of the utmost importance; all markings should be explained. Communication routes should be emphasized by depicting land routes in black and water routes in blue. Varying widths of black lines or dashes may be used to indicate different types of roads or pathways. Water routes should be marked heavily enough to distinguish them from streams. Trafficability may be indicated by a system of crosshatching in black; different types of soil or various kinds of vegetation may be shown by a crosshatching scheme in colors. The reporter may use any system of marking that is easily comprehensible.

c. Photographs. Aerial and ground photographs may also be attached to reports to illustrate or supplement the information. A good photograph, when examined by experts, may give more and better information then many pages of narrative. Photographic coverage should be well planned. Whenever possible, all scenes and objects should be photographed from several angles. It is important that distances and dimensions in photographs be indicated by inclusion of people, vehicles, and other objects of known size. Photographs should be annotated and amply referenced. The date and exact time of day a photograph was taken must be included; otherwise, the information may be of little or no value. Vertical aerial photographs in stereoscopic pairs taken so as to provide scales of $\frac{1}{6000}$ to $\frac{1}{12000}$ feet provide sufficient detail. Sample photographs of intelligence value are shown in appendix H. In the field army, photographic units are located at division, corps, and army levels. In the continental United States, photographic service is furnished by photographic laboratories strategically located within each continental Army area. Although photographic coverage is normally the responsibility of the signal support units, photographs obtained from any source are useful.

4–17. Evaluation by Collection Agency

The headquarters closest to the source and agency should put an evaluation rating (para 5–2) on all reports. This evaluation indicates to the next user (normally the processor) of the information the credibility and reliability of the source and of the information itself. The source and date of information should be given whenever possible.

CHAPTER 5

PROCESSING INFORMATION AND PREPARING INTELLIGENCE FOR DISSEMINATION

5–1. General

The transportation officer reviews transportation information reported to him by units and activities under his supervision and forwards it to the staff intelligence officer. He maintains transportation intelligence, including special transportation studies and sections of National Intelligence Surveys that are required in transportation planning. Transportation intelligence is produced by processing transportation information: processing consists of recording, evaluating, and interpreting information collected.

5–2. Processing Procedure

a. Recording. Recording is the systematic selecting, sorting, grouping, cataloging, and filing of information. Recording must be systematic to insure minimum delay in evaluating the information obtained. Common aids used in recording are G2 journals, enemy situation maps, and G2 worksheets and intelligence files. See FM 30–5 for a detailed description of these aids.

b. Evaluating. Each processor evaluates items of information for pertinence, meaning, reliability of source, and probable accuracy. Methods of evaluation are discussed in FM 30–5 and FM 30–16. Evaluation is essential because in many instances the processing agency has knowledge about the credibility and reliability of the information that is not available to the collecting agency. The processor assigns his own evaluation rating to each item of information. The evaluation rating system explained below is used to indicate the reliability of information sources and the probable accuracy of the information itself.

c. Reliability. Reliability of source is graded as follows:

A —COMPLETELY RELIABLE
B —USUALLY RELIABLE
C —FAIRLY RELIABLE
D —NOT USUALLY RELIABLE
E —UNRELIABLE
F —RELIABILITY CANNOT BE JUDGED.

d. Classifications. The following classifications extracted from STANAG 2022 are used to indicate the accuracy of information.

(1) *Confirmed by other sources.* If it can be stated with certainty that the reported information originates from another source than the already existing information on the same subject, it is classified as confirmed by other sources and is rated "1."

(2) *Probably true.*

(*a*) If no proof in the above sense can be established, and if there is no reason to suspect that the reported information comes from the same source as the information already available on this subject, it is classified as probably true and is rated "2."

(*b*) If the essential content of the report is confirmed by information already available, the accuracy rating of "2" is also given the unconfirmed information contained the report.

(3) *Possibly true.* If the investigation reveals that the reported facts, on which no further information is yet available, comply with the behavior of the target intelligence mission objective as observed up to now, or if the known background of a person leads to the conclusion that he might have acted as reported, the information received is classified as "possibly true" and is rated as "3."

(4) *Doubtful.* Reported unconfirmed information, the contents of which rather contradict the estimate of the development or the hitherto known behavior of the target, is classified as "doubtful" and is rated "4" as long as this information cannot be disproved by available facts.

(5) *Improbable.* Reported information which is not confirmed by available data but rather con-

tradicts an estimate hitherto assumed to be reliable in regard to the development of a case and that is classified as "improbable," is rated "5." The same classification is given to reported information which contradicts existing data on a subject that has originally been rated "1" or "2."

(6) *Truth cannot be judged.*

(*a*) If the investigation of a report reveals that a basis for allocating rating "1" to "5" is not given, the reported information is classified as "truth cannot be judged" as is rated "6."

(*b*) The statement that a report cannot be judged as to its accuracy is always preferred to an inaccurate use of ratings "1" to "5." However, a rating of "1" or "2" should always be considered. The rating "6" should be given only if a rating of "1" to "5" is not possible because no information on the same target is available.

e. Interpreting. Interpretation is the process of critical analysis: it is judging information in the light of previously acquired knowledge and experience and determining its significance in terms of capabilities, limitations, and courses of action. The intelligence officer must decide what the data means when compared with what is already known: he must decide whether it verifies, alters, adds significance to, or refutes information already processed and whether it tends to confirm or change the existing estimate of a situation. Interpretation consists of analysis and intergation.

(1) *Analysis.*

(*a*) Analyzing information consists of sorting the information and arranging the same or relating subjects in basic groups. This systematic arrangement facilitates a critical comparison of the elements and clarifies their relationship. Each new piece of information received and processed to the point of interpretation may affect, to some degree, the transportation intelligence estimate: old capabilities may be replaced with new ones, evaluations upgraded or downgraded, and conclusions changed. If conflicting information about the enemy is obtained from sources with the same reliability rating, the possibility of enemy counterintelligence must be carefully considered.

(*b*) Only pertinent information must be integrated into the transportation plan: information that has no possible bearing on transportation should be discarded. Nevertheless, before information is discarded as not pertinent, coordination must be effected with other agencies because the information may be pertinent to them.

(2) *Integration.* Integration is the combining of basic groups of information into a logical and reasonable pattern—the converting of information into true intelligence. This requires judgment and the same type of transportation background that analyzing information requires. Depending upon the situation, the process of integration may be a short mental sifting of pertinent data, or it may be a lengthy and detailed sorting of information.

5–3. Maintaining Transportation Intelligence

Collectors, processors, and particularly the users of transportation intelligence should never be satisfied with any given status of the intelligence situation. The transportation estimate should be continuously revised and kept up to date in the light of new information received. Because the intelligence process is continuous, close and systematic, liaison with all pertinent agencies, including operating units, is mandatory. To insure the production and maintenance of authentic and timely intelligence—

a. Question and requestion all enemy personnel.

b. Obtain and examine new documents and reexamine old ones.

c. Continue to study and evaluate transportation equipment and facilities.

d. Evaluate and reevaluate communication systems, terrain, geography, climate, season, weather, hydrology, contaminated areas, and concealment.

e. Repeat reconnaissance and field trips, including aerial and ground photography.

f. Maintain contact with military units and civilian agencies.

g. Maintain continuous liaison with collection agencies.

5–4. The Transportation Intelligence Estimate

The transportation intelligence estimate is a study that describes, discusses, and applies interpreted data that are directly or indirectly applicable to the transportation mission. The transportation intelligence estimate helps the commander make sound and timely decisions; it is a part of the overall transportation estimate that is used to formulate the transportation plan. An intelligence estimate is made after all available information has been collected and processed; however, an esti-

mate must be kept current. It must be revised when new or additional information is received and processed. Estimates must be disseminated to appropriate planners in sufficient time to be useful. Should time not permit the making and publishing of formal transportation plans, intelligence estimates may be disseminated directly to the ultimate users, that is, the operating units. Elements that should be considered in a transportation intelligence estimate are listed below. Each estimate will not necessarily contain all of the elements listed: content will depend upon the transportation mission.

a. Statement of the transportation mission.

b. Characteristics of the area of operations that will affect this mission.

(1) Weather and climate.

(2) Terrain features.

(3) Road and rail nets, including traffic bottlenecks.

(4) Bridges and tunnels.

(5) Port and beach facilities and wharves.

(6) Airfields and other aircraft facilities.

(7) Inland waterways, locks, ports.

(8) Warehouses and other storage facilities.

c. Characteristics of enemy transportation equipment.

(1) Locomotive characteristics and inventory.

(2) Freight and passenger equipment characteristics and inventory.

(3) Vehicle characteristics and inventory.

(4) Crane data.

(5) Waterway craft census.

(6) Aircraft characteristics and inventory.

d. Transport capability of the enemy: air, water, motor, rail, miscellaneous.

e. Conclusions, including effect of the intelligence estimate on our own forces.

5–5. Security Classification of Transportation Information and Intelligence

a. Transportation intelligence consists principally of our knowledge of the enemy's transportation system or of transportation systems under his control; this knowledge should be classified if the enemy's awareness of it could help him. We classify documents and materiel that deal with our own forces to deny the enemy knowledge concerning them; it follows that we must exercise the same caution in denying the enemy our intelligence about his forces. Failure to do this will give him an opportunity to accomplish effective counterintelligence.

b. For information and intelligence not already classified, the degree of classification is determined by the commander of the echelon in which the information originates; subsequent reclassification by higher authority may follow. All transportation personnel must bear in mind that if the enemy is aware of what we know about him, his countermeasures may partly or completely neutralize our intelligence effort.

CHAPTER 6

DISSEMINATION AND USE OF TRANSPORTATION INTELLIGENCE

6–1. Objective

Intelligence may be used as a basis for command decisions; it must be available in sufficient time to be useful. The primary objective of dissemination is the timely placing of intelligence in the hands of the ultimate user for the formulation of capability estimates and operational plans.

6–2. Methods

Intelligence required by specific transportation sections or units is disseminated to them through staff and command channels. Exchange of intelligence with intelligence agencies of other branches and services is through the G2 of the command. Media used to disseminate intelligence depend upon the detail, pertinence, urgency, and intended use of the intelligence. Transportation intelligence may be disseminated by any of the means outlined in FM 30–5, 30–16, and 101–5. Methods of dissemination are formal reports, documents, maps, photographs, informal messages, displays and exhibits, personal contacts, and telecommunication systems. Media commonly used to disseminate transportation intelligence are described below.

a. National Intelligence Surveys. Transportation sections of the National Intelligence Surveys contain intelligence on railways, motor transport, water terminals, inland waterways, and aviation produced by transportation agencies in coordination with the Corps of Engineers and Office of Naval Intelligence. Other sections of these surveys contain intelligence on subjects of interest to, but not the responsibility of, transportation planners such as pipelines and airfields.

b. Transportation Intelligence Summary. Periodic summaries of current transportation intelligence are prepared by transportation staff officers. Such summaries are provided the Assistant Chief of Staff for Intelligence; the transportation staffs of higher, lower, and adjacent headquarters; and other interested agencies as authorized by the Assistant Chief of Staff for Intelligence.

c. Recurring Reports.

(1) *The intelligence summary.* This summarizes in telegraphic style intelligence for a specified period.

(2) *Periodic intelligence reports.* These are written reports that cover a longer period than an intelligence summary.

d. Studies and Reports Made as Required.

(1) *Special transportation studies.* Special transportation studies prepared by transportation agencies on railways, motor transport, water terminals, inland waterways, and aviation are given limited distribution. These studies are analyses of basic transportation facilities and resources as they relate to given operational situations in actual or potential areas of military operations. Transportation studies prepared by theaters and armies encompass smaller areas and normally contain more detailed and up-to-date intelligence on specific routes and modes than studies prepared by transportation agencies.

(2) *Climatic studies.* These studies are prepared by supporting Air Weather Service detachments.

(3) *Spot reports.* Spot reports contain information and intelligence that must be disseminated immediately.

(4) *Prisoner-of-war interrogation and translation reports.*

(5) *Photointerpretation reports.*

(*a*) *Immediate.* Supplement oral spot reports.

(*b*) *Mission review.* Contain a summary of information and intelligence on installations, activities, and areas.

(*c*) *Detailed.* Contain precise information and intelligence based on photography and other sources.

(*d*) *Summary.* Consolidate information and intelligence from earlier photographic reports.

(*e*) *Special.* Consolidate information and intelligence from earlier photographic reports.

(6) *Summaries of weather and climate.* Usually prepared by supporting Air Weather Service detachments.

(7) *Technical intelligence bulletins and summaries.* Report results of examination of enemy equipment and facilities.

(8) *Order of battle books and handbooks.* Contain information and intelligence on foreign units and nations.

e. Operation Plans and Orders. Paragraph 1 of the intelligence annex of operation plans and orders is commonly used to disseminate information and intelligence.

6–3. Uses

a. Strategic Planning. Intelligence concerning transportation modes, systems, facilities, and materiel is an essential element in the making of strategic plans. Other intelligence affecting the making of these plans pertains to terrain (rivers, mountains, deserts, swamps, forests, etc.), weather and climate, and the agricultural and industrial economy of the theater of operations. Transportation Corps personnel concerned with transportation planning and intelligence activities use transportation intelligence to determine the capabilities, vulnerabilities, and probable uses of transportation facilities by the enemy. Intelligence is also used to determine the capacities, capabilities, and potentialities of the use of foreign transportation facilities by our own and friendly military forces. Strategic intelligence planning is usually the result of assembling and studying a large volume of detailed information; it is normally accomplished at field army level or above. At the beginning of military operations, the greater part of strategic intelligence is derived from studies of maps; ports and beaches; rivers; towns and terrain features; lines of communication; and technical, economic, operational, and communications intelligence summaries. Sociological, political, and biographical intelligence summaries are also of vital importance to strategic planning.

b. Tactical Planning. Transportation intelligence is essential for planning tactical operations because it includes terrain features, road nets and their condition, bridges and other structures affecting movement, weather and climate, and other considerations affecting tactical movement by the enemy or friendly forces. Transportation intelligence may also include knowledge about enemy installations and equipment suitable for the tactical use of our forces. Anticipation of intelligence needs is a part of tactical planning; information about items of current interest and those of probable value in the immediate future should be collected and analyzed. The intelligence obtained is normally used at corps level and below.

c. Research and Development. Transportation intelligence developed in peacetime, as well as that developed during hostilities, is a great aid in the research and development of transportation concepts, materiel, and facilities. Captured enemy plans, facilities, and equipment provide research and development personnel with valuable knowledge about the enemy's status of supply technological advancement and ability to wage war. This knowledge is a factor in the timely development of appropriate countermeasures. Research and development intelligence is normally used in CONUS by the Director of Research and Development, in coordination with the other assistant secretaries of the Army. The military chiefs in the Department of the Army who are primarily concerned with this intelligence data are the Assistant Chief of Staff for Intelligence, the Chief of Research and Development, the Deputy Chief of Staff for Logistics.

APPENDIX A

REFERENCES

A–1. ARMY REGULATIONS (AR)

(C) 10–122	United States Army Security Agency (U).
75–14	Responsibilities for Explosives Ordnance Disposal.
75–15	Responsibilities and Procedures for Explosives Ordnance Disposal.
190–60	Physical Security Standards for Nuclear Weapons.
310–31	Organization and Equipment Authorization—Tables of Organization and Equipment.
380-series	Military Security.
381–9	Army Scientific and Technical Intelligence.
755–26	Captured Enemy Equipment and Other Foreign Materiel.

A–2. FIELD MANUALS (FM)

3–1	Chemical, Biological, and Radiological Support.
5–25	Explosives and Demolitions.
5–30	Engineer Intelligence.
5–31	Boobytraps.
5–36	Route Reconnaissance and Classification.
8–10	Medical Service, Theater of Operations.
9–6	Ammunition Service in the Theater of Operations.
9–15	Explosive Ordnance Disposal Unit Operations.
19–1	Military Police Support, Army Divisions and Separate Brigades.
19–40	Enemy Prisoners of War and Civilian Internees.
29–22	Maintenance Battalion and Company Operations (Nondivisional).
29–30	Maintenance Battalion and Company Operations in Divisions and Separate Brigades.
30–5	Combat Intelligence.
30–9	Military Intelligence Battalion, Field Army.
30–10	Terrain Intelligence.
30–15	Intelligence Interrogation.
30–16	Technical Intelligence.
31–23	Stability Operations—U.S. Army Doctrine.
31–45	Explosives Ordnance Disposal Service.
(C) 32–5	Signal Security (SIGSEC) (U).
(S) 32–10	USASA in Support of Tactical Operations (U).
33–1	Psychological Operations—U.S. Army Doctrine.
33–5	Psychological Operations—Techniques and Procedures.
41–10	Civil Affairs Operations.
55–15	Transportation Reference Data.
55–20	Army Motor Transport Operations.
55–30	Army Motor Transport Operations
100–5	Operations of Army Forces in the Field.
100–10	Combat Service Support.

(C) 100–20	Field Service Regulations—Internal Defense and Development (IDAD) (U).
101–5	Staff Officers' Field Manual: Staff Organization and Procedure.

A–3. Army Subject Schedules (ASubjScd)

30–46	Technical Intelligence Personnel.

A–4. Tables of Organization And Equipment (TOE)

30–18	Military Intelligence Detachment, Corps or Military Intelligence Detachment, Airborne Corps.
30–25	Military Intelligence Battalion, Field Army.
30–34	Military Intelligence Company, Technical Intelligence.
30–600	Military Intelligence Organization.

A–5. Standardization Agreement

2022	Intelligence Reports.

APPENDIX B

AVIATION INFORMATION REQUIREMENTS

B–1 Areawide Information

Aviation intelligence includes information about the topics noted below.

a. Brief history of the aircraft industry and its development.

b. Brief history of the aircraft industry and its development.

c. Capabilities of commercial air transport companies.

d. Inventory of aircraft, including number, types, and characteristics.

e. Location of aircraft observed within the country and the number observed at any one time.

f. Procurement policies and procedures of military ground force units in the acquisition of aircraft.

g. Doctrine:

(1) Present and planned tactical doctrine concerning the use of aircraft in ground force units.

(2) Military agencies responsible for developing doctrine for the employment of aircraft.

(3) Effects or influence of nuclear warfare on current concepts of aircraft operations in the combat zone.

h. Command or Control of Aircraft:

(1) In each arm or service under both normal and emergency conditions.

(2) Employment:

(*a*) Individually, in groups, or in mass.

(*b*) Purpose: reconnaissance, transport of troops and cargo, medical evacuation, command, courier, liaison, nuclear and CBR warfare (in either dispensing or detection role), utility purposes, such as aerial wirelaying and radio relay.

(*c*) Use of rotary-wing aircraft in night flights—extent and purpose.

(*d*) Use of rotary-wing aircraft in ship-to-shore operations.

(*e*) Special techniques of employment.

i. Organization and Training:

(1) Organizational structure. (Tables of organization and equipment show structure.)

(2) Type, number, characteristics, and location of aircraft units and their equipment.

(3) Aircraft assignments—in support of ground units or attached on a permanent basis.

(4) Publications: organizational, operational, training, maintenance, etc.

(5) Location of schools for training pilots and mechanics.

(*a*) Length of courses.

(*b*) Types of aircraft used in training.

(*c*) Flying hours required to complete training: pre-solo, intermediate, and advance phase.

(*d*) Cross training of pilots between fixed-wing and rotary-wing aircraft.

(*e*) Sources for pilot and mechanic students.

(*f*) Evaluation of the training program.

(*g*) Training of ground troops in loading or unloading helicopters.

(*h*) Training exercises by aircraft units, either alone or with other air or ground units.

(*i*) Frequency of accidents and their causes.

j. Supply and Maintenance.

(1) Organizational structure for supply and maintenance.

(2) Critical items of supply or maintenance.

(3) Average life in flying hours of propellers, rotor blades, engines, transmissions, and other critical items.

(4) Extent to which aircraft unit performs its own maintenance in the field.

(5) Days' of supply carried with each unit.

(6) Ratio of maintenance hours to flying hours.

(7) Maintenance procedure based upon number of flying hours, calendar, or as needed.

(8) Major causes for need of maintenance.

(9) Maintenance difficulties and man-hours required to perform routine or periodic inspections or maintenance tasks.

(10) Location and characteristics of facilities for maintenance and/or production of aircraft and repair parts.

(11) Air transportability of light aircraft.

k. Research and Development:

(1) Current trends, policies, and procedures in research and development.

(2) Types of aircraft in the research and development stage.

(3) Flight and load-carrying characteristics, capabilities, and limitations of these aircraft.

(4) Names, background, and significant details of individuals connected with program.

l. Facilities and Construction:

(1) Army airfield and heliport characteristics.

(*a*) Location and name.

(*b*) Type: emergency landing and refueling and rearming strips, advanced landing ground, photographic reconnaissance, troop-carrier, supply and evacuation, heliport. In addition air bases, air depots, and airstrips for liaison aircraft.

(*c*) Operational and permanency status: fully operational, limited operational, emergency, permanent, temporary.

(*d*) Runways: dimensions, angle of axis to prevailing winds, type of construction, regularity of surface, visibility conditions, lighting of runway.

(*e*) Runway approaches: flare angle and glide angle, including height, nature, and location of obstructions beyond each end of runway; prevailing winds.

(*f*) Runway shoulders: materials, dimensions, and surfaces.

(*g*) Hardstands and taxiways: location, dimensions, surface, revetments, and size of parking area.

(*h*) Warmup aprons: location, dimensions, and surface.

(*i*) Operational facilities: control tower and equipment, operations and briefing rooms, and other facilities.

(*j*) Fuel storage: number, character, capacity and location of containers; description of dispensing system.

(*k*) Housekeeping facilities: offices, living quarters, messing and recreational facilities, utilities—including firefighting, roads and walkways, road and railroad connections, communications.

(*l*) Repair and maintenance facilities.

(*m*) Natural and artificial camouflage.

(*n*) Physicial condition of installation and facilities.

(*o*) Vulnerability to nuclear weapons.

(*p*) Safety and security features.

(2) Availability of field lighting, firefighting, and rescue equipment.

(3) Traffic control system and navigational aids.

(4) Materials handling equipment.

m. Personnel:

(1) Military: number of officers, number of enlisted men, degree of training, and morale.

(2) Civilian: number, proficiency, and reserve training status.

(3) Data on key personnel: military and civilian.

B–2. Technical Data on Individual Aircraft

a. Aircraft Characteristics and Inventory. Number available and types of all aircraft used in support of ground force operations (reconnaissance and observation, cargo, utility, liaison, command, light fixed-wing, rotary-wing, convertiplane, vertical takeoff and landing (VTOL), short takeoff and landing (STOL), amphibious, etc).

b. Production Capabilities.

c. Mobilization Capabilities.

d. Make and Model. Experimental, service test, or production.

e. Characteristics.

(1) Powerplants:

(*a*) Number.

(*b*) Location.

(*c*) Type: internal combustion, jet, turbine, rocket.

(*d*) Horsepower.

(*e*) Carburetors, air filters, engine cooling.

(*f*) Propeller diameter.

(2) Landing gear:

(*a*) Fixed.

(*b*) Retractable.

(*c*) Type: wheels, skids, floats, etc.

(3) Transmissions: type and number, including freewheeling devices and power takeoff.

(4) Empty weights.

(5) Gross weights: normal overload.

(6) Fuel type and capacity.

(7) Lifting surfaces:

(*a*) Diameter, number, location, direction, and planes of rotation of rotor systems on rotary-wing aircraft.

(*b*) Number and construction type of rotor blades.

(*c*) Types of deicing equipment, if any, for rotor blades or other components.

(*d*) Stub wings and other airfoils.

(*e*) Wing span, area, thickness, shape, taper ratio, etc.

(8) Method and ease of control.

(9) Control surfaces:

(*a*) Type and dimensions of tail unit.

(*b*) Rudders.

(*c*) Elevators and ailerons, etc.

(*d*) Flaps, brakes, spoilers, and trim tabs.

(10) Fuselage:

(*a*) Design.

(*b*) Construction type: strength, materials.

(*c*) New developments.

(*d*) Overall dimensions: length, width, and height.

(11) Maintenance policies and procedures, ease of maintenance, special equipment required, etc.

(12) Radio equipment by model:

(*a*) Transmitter.

(*b*) Receiver.

(*c*) Other electronic equipment.

(13) Cockpit arrangement: instrumentation, friend or foe identification (IFF) device, etc.

(14) Location and size of cargo or passenger compartments:

(a) Length.

(*b*) Width.

(*c*) Height.

(*d*) Cube.

(*e*) Floor loading restrictions.

(*f*) Center of gravity.

(*g*) External cargo facilities, including litters.

(*h*) Location, number, size, and tensile strength of tiedown rings.

(*i*) Methods of loading: hand, ramp, hoist, elevator, etc.

(*j*) Type and size of cargo loading doors or ramps.

(15) Provisions for towing.

(16) Takeoff and landing devices:

(*a*) Catapult or JATO devices.

(*b*) Retardation devices—arresting gears.

(17) Wing-folding or other means of increasing transportability.

(18) Special equipment:

(*a*) Flight instruments, homing devices, radio, and radar.

(*b*) Deicing and defrosting.

(*c*) Aerial wire laying.

(*d*) Litter pods.

(*e*) Cargo loading and unloading devices.

(*f*) Special containers and drop platforms.

(*g*) Airdrop release mechanisms.

(*h*) Photographic.

(*i*) Armor and armament.

(*j*) Equipment for transporting missiles.

f. Performance Data.

(1) Payload: passengers and/or cargo.

(2) Crew number.

(3) Speeds: maximum, cruising, minimum.

(4) Cruising radius or range.

(5) Ceiling: absolute, servicing, hovering (in and out) ground effect.

(6) Rate of climb.

(7) Takeoff distance: ground run to clear 50-foot obstacle.

(8) Landing distance: ground role from 50-foot obstacle.

(9) Autorotational (forced-landing) capabilities and characteristics.

(10) Approach and takeoff angles.

(11) High altitude or mountain operations.

(12) Cold-weather starting and operation.

(13) Desert and jungle operations.

(14) All-weather flight provisions.

g. Materials Used in Aircraft Construction.

h. Photographs, Sketches, and Drawings.

B–3. Information Sources

a. Documents.

(1) Charts, technical manuals, field manuals, tables of organization and equipment, organizational tables, or other documents showing organization, mission, functions, and responsibilities of each technical service regarding the use of aircraft in ground force units.

(2) Military reports, records, documents, texts, plans, and brochures giving aircraft inventories or registrations, current doctrine, control, organization, research and development, and other procedures for the employment of aviation in the ground forces.

(3) Government reports indicating the number, types, use, and importance of both military and civilian aviation.

(4) Commercial handbooks, brochures, manuals, catalogs, etc. These documents usually contain types of performance data of both military and civilian aircraft.

(5) Research and development plans and reports and other technical and scientific publications.

(6) Aircraft registers or inventories showing number, types, and characteristics.

(7) Design and construction standards. Basic standards for construction of airfields and heliports may be found in engineering texts, pamphlets, and/or government publications, such as technical manuals, field manuals, etc.

(8) Airfield construction plans and progress reports.

(9) Military status reports and/or documents indicating maintenance policies and procedures used for airports and heliports.

(10) Aerial and ground photographs of aircraft and facilities.

(11) Aeronautical charts, maps, graphs, etc.

(12) Newspapers, aviation magazines, and other current periodicals.

(13) Bills of materials.

b. Agencies.

(1) Ministry of aviation.

(2) Ministry of communications.

(3) Foreign ministry (similar to U.S. State Department).

(4) Governmental trade organizations.

(5) Aircraft and/or equipment manufacturers.

(6) Army, Navy, and Air Force elements.

(7) Commercial airlines.

(8) National aeronautics administration.

(9) Airports and other air terminals.

(10) Weather, statistical, and tourist bureaus.

B–4. Estimating Aircraft Movement Capability

a. General. To assess the enemy's capability to move personnel and supplies by certain types of aircraft, the analyst must make assumptions and consider the various factors involved. Some or all of the factors discussed below will apply to a particular problem depending primarily upon the type of aircraft employed. Assumptions, factors involved, and methods of making capability estimates are given below.

b. Assumptions.

(1) Aviators and ground crews are proficient.

(2) Adequate landing and takeoff sites are available.

(3) Ground handling equipment is adequate.

(4) Aircraft are used only on tactical missions.

c. Factors Involved. Depending upon the nature of a particular mission, the analyst must consider the following factors.

(1) *Type and number of aircraft involved.* Helicopters, although inferior to fixed-wing aircraft in speed and range, are especially valuable because of their landing, takeoff, and hovering capability. They can operate in areas that are inaccessible to fixed-wing aircraft and be loaded and unloaded in less time than fixed-wing aircraft. On the other hand, fixed-wing aircraft can generally operate more hours per day with a higher sustained availability.

(2) *Loading.*

(*a*) Weight of cargo and lift capability (payload) of aircraft.

(*b*) Configuration of cargo in relation to size of cargo compartment and cargo compartment doors.

(*c*) Sling loads for helicopters.

(*d*) Wing loads for fixed-wing aircraft.

(3) *Hours of daily operation.*

Helicopter	4
Fixed-wing	6

(4) *Miles in the hour.* Speed plus loading, unloading, and flying time will determine miles in the hour. Operational hours and distance can then be used to compute the number of round trips each

aircraft can make. The average loading and unloading times are:

	Helicopter Load or Unload (min)	Fixed-Wing Load (min)	Aircraft Unload (min)
Troop	3	2 to 3	1
Casualties	10	10	10
Cargo inside	5	10 to 30	5 to 15
Cargo on slings	0.5	—	—
Wing loads	—	10	10

(5) *Daily round trips per aircraft.* This is obtained by multiplying operating hours by miles in the hour and dividing this product by the distance.

(6) *Availability.* Availability is affected by the adequacy and efficiency of maintenance and supply and the relative location of operating and service units. The average availability of aircraft on hand for sustained and short-term operation is:

	Sustained (percent)	Short-term (percent)
Helicopters	67	90
Fixed-wing	75	90

(7) *Aircraft requirement.* The aircraft required to accomplish a mission is determined by two factors—the basic requirement and the type of operation.

(*a*) *Basic.* The number of aircraft needed to meet the basic requirement is obtained by dividing the total tonnage to be moved by the payload of one aircraft of the type to be used in the operation.

(*b*) *Type of operation.* The basic aircraft requirement figure has to be adjusted according to the variable factors involved. The most common variable factors are:

1. Distance. Distance causes the fuel and payload relationship to vary inversely. When the operation exceeds 50 miles, the basic aircraft requirement should be increased approximately 7 percent for each 20-mile increment.

2. Sustained operations. In a sustained operation, the basic number of aircraft required should be increased by 50 percent.

3. Combat loading. A 10 percent increase of the basic requirement is necessary for combat loading.

4. Miscellaneous variables. As altitude and/or temperature increase the aircraft requirement will also increase because of a decrease in weight-lifting capability. Humidity and other weather conditions also affect the aircraft requirement. Adjustments made because of these variables must be determined by the analyst.

d. Making the Estimate. When estimating the enemy's aircraft requirement or the tons he can move daily by aircraft, the formula to be employed and examples of its use and explained below.

(1) *Formula.*

$$A = B \times C \times D$$

where A = daily tonnage capability
B = daily round trips flown per aircraft
C = payload of one aircraft
D = aircraft employed

(2) *Movement by helicopter.*

(*a*) *Problem.* What is the daily lift capability for 1 day of 24 helicopters in the communications zone

where 4 = operational hours
90 = average speed in miles in the hour (includes loading and unloading time)
75 = round trip distance in miles
90 = percent of aircraft
1.4 = short tons of payload for each aircraft
0.9 = availability of 90 percent

(*b*) *Solution.*

$$B = \frac{4 \times 90}{75} = 5 \text{ round trips per aircraft}$$

$A = 5 \times 1.4 \times 25 \times 0.9 = 157$ short tons per day

(3) *Movement by fixed-wing aircraft.*

(*a*) *Problem.* What is the sustained fixed-wing aircraft requirement to move 500 short tons of cargo per day a distance of 35 miles under combat conditions

where 1.1 = multiplier for combat loading
1.5 = multiplier for sustained operations
1.4 = short tons of payload for each aircraft
80 = average speed in miles in the hour (includes loading and unloading time)
6 = operational hours per day

(*b*) *Solution.*

$500 \times 1.1 = 550$ (adjusted tonnage for loading)

$$B = \frac{6 \times 80}{2 \times 35} = 7 \text{ round trips per aircraft}$$

$$D = \frac{550 \times 1.5}{7 \times 1.4} = 84 \text{ aircraft for sustained operations}$$

APPENDIX C

INLAND WATERWAY INFORMATION REQUIREMENTS

C–1. Areawide Information

Essential information of intelligence value about inland waterways includes facts about the topics outlined below.

a. Importance of Navigable Inland Waterways (Rivers, Inland Lakes, Inland Channels, Canals) and Waterway Transportation in the Country or Area.

(1) Place in the national economy, including relationship to industry and agriculture and to other modes of transportation.

(2) Ownership, history of development, and influencing factors, including an account of war damage and rehabilitation.

(3) Relationship to port, beach, and landing area facilities and operations, including potentialities for major improvement or development for military purposes.

b. Description and Analysis of the Waterway Transportation System.

(1) Indication of the geographical distribution of navigable inland waterways, including intracoastal waterways, and an explanation of the country's waterway classification system.

(2) Small scale annotated maps, charts, and diagrams indicating the name and navigable length of each waterway; principal ports and landing places; passing basins and tieup areas; ferry crossings and stations; dams, bridges, aqueducts, locks (single and double), tunnels, and other critical features; major repair and servicing facilities; and location of controlling channel depths, widths, and clearances.

(3) Tabulation of waterway mileages by systems, individual waterways, operating divisions, and type of waterway.

(4) Details of inland waterways' communication and dispatching systems and facilities.

(5) Discussion of official construction standards for inland waterway canals and waterway facilities and the extent to which the standards are followed.

(6) Details of status and scheduling of current projects and proposed plans for the development or improvement of inland waterways and waterway transportation.

(7) Details of the waterway network: operating conditions, limitations, capacities, and military potentialities.

(8) Details of the organization, training, operations, and capabilities of inland waterway transportation units in the country's military service, including tables of organization and equipment, training literature and related doctrine.

(9) Explanation of local terminology used to describe inland waterways and waterway transportation activities and facilities.

c. Organization and Administration of Inland Waterway and Waterway Transportation.

(1) Ownership, funding, regulatory controls imposed by government, and extent of foreign influence and interests.

(2) Location, organization, and functions of agencies responsible for control and administration of inland and intracoastal waterway transportation.

(3) Number of waterway administrative personnel by departments and divisions; their training, education, technical qualifications, and efficiency.

(4) Size and quality of the skilled and unskilled labor force, centers where recruited, training and experience, working conditions and wage scales, organization of crews, and attitude toward citizens of the United States—unfriendly and friendly elements.

(5) Financial statistics, including waterway rates, operating revenues and expenses, and

foreign financial aid received for waterway development.

d. Waterway Operations Data.

(1) Operating regulations and methods, standards for freight and passenger traffic, and methods of documentation.

(2) Operating statistics tabulated and analyzed for each waterway and for the network as a whole including data about:

(*a*) Total freight ton-miles of cargo transported and passenger-miles traveled.

(*b*) Total tonnage by commodity.

(*c*) Average time and distance of freight haul.

(*d*) Average vessel turnaround time.

(*e*) Average freight (net tons) and/or passengers hauled per unit.

(*f*) Maximum number of vessels, by type, which are operated over the various routes, in each direction, during normal and peak periods; potential traffic.

(*g*) Average loading and discharge rates.

(*h*) Size and type of tows.

(*i*) Maximum permissible length, draft, beam, and load of vessels using the route.

(*j*) Mileages and terminals for operating divisions or sections of the route, if so designated.

(*k*) Tabulations showing incidence of major traffic interruptions by type, cause, season, and area.

(*l*) Tonnages handled at principal loading, unloading, and transfer points.

(*m*) Determination of throughput capacity.

(3) Discussion of major transport organizations: location of offices, vessels owned and operated, routes used, nature and volume of traffic, repair and servicing facilities, communication and dispatch facilities, and efficiency of operations and maintenance in general and in terms of vessels deadlined.

e. Waterway Craft Statistics.

(1) Waterway craft census for each waterway and/or for the waterway network as a whole.

(2) Special equipment census for each waterway and/or for the waterway network as a whole.

(3) Number, type, and characteristics of waterway craft and other waterway equipment manufactured, imported (from whom), and exported (to whom) annually, including towed and self-propelled barges and tankers, tugs, and towboats, floating cranes, landing craft, floating machine shops, passenger and cargo vessels, dredges, and icebreakers (app E, para E–2*b*(14)).

(4) Dimensions of watercraft.

f. Waterway Transportation Research and Development (Civil and Military).

(1) Research and development policy, funding, objectives, and capabilities.

(2) Testing and development centers, facilities, equipment, and key personnel.

(3) Current waterway research and development projects and progress; important past accomplishments, including evaluation of effectiveness.

C–2. Detailed Description of Individual Waterways

a. Route Identification and Details.

(1) *Identification.* Waterway name, location, characteristics, and relationship to other waterways and to other modes of transportation. Information should include:

(*a*) Type of waterway: lake, river, canal.

(*b*) Description of adjacent terrain: delta, marsh, hills, mountains, desert, jungle.

(*c*) Dimensions of waterway: length, width, depth. If necessary, attach a sketch of major deviations with dimensions.

(*d*) All channel locations.

(*e*) Source of water for waterway: streams, seasonal rains, pumping stations.

(*f*) Dates when waterway is open and closed because of such conditions as freezing, flood, low water, repairs.

(*g*) Branches: location, name, navigability.

(*h*) Silting characteristics.

(*j*) Composition of bottom and sides: clay, gravel, mud, concrete, stone, vegetation. Cross-sectional sketches are useful.

(*j*) Embankments: location, height, and composition.

(*k*) Passing basins and areas: location, size, depth.

(*l*) Obstructions. Nature of obstructions: tidal bores, rapids, reefs, sandbars, whirlpools, wrecks, shoals, narrows, snags, scouring, landslides, excessive vegetation. Effect of obstructions on navigation and methods of bypassing, such as pilotage, towing from shore, and poling.

(2) *Approaches and entrances.* Usual method of approach, nature of approach, and conspicuous

objects; controlling depth and width of channel across bar, shoals and alternate channels; and any critical or unique feature.

(3) *Tides and currents.* Mean and spring tidal ranges; upper limit of tidal rise (mile station); seasonal water level variations; average speed of current by seasons.

(4) *Navigability.* Total length and navigable length (if a lake, area and maximum length and width); navigation limits for vessels of different drafts and characteristics; seasonal controlling widths and depths, distinguishing between total width of river and width of navigable channels; effect of obstacles and other hazards; duration of navigable season and normal closing date.

(5) *Channel (attach charts).*

(*a*) Depth and bottom width, with seasonal variations and flood states. Give character of bottom and known obstructions.

(*b*) Character of banks, including overhanging vegetation.

(*c*) Critical bends: location, degree of bend, visibility.

(*d*) Aids to navigation, such as buoys, lights, range marks, and foghorns.

(6) *Effect of wind on waterway.*

(7) *Effect of seasonal changes.*

b. Structures and Facilities.

(1) *Aqueducts.* Location (mile station, coordinates, etc), length and width, height above stream or obstacle overpassed, and construction details.

(2) *Dams and reservoirs.* Location, design, construction material, purpose, means of bypassing; hydroelectric powerplants, and seasonal variations in water supply.

(3) *Pumping station.* Function, location, construction, arrangement, dimensions, and power used.

(4) *Ferries and ferry stations.* Location, type, power, service rendered, capacity, operating schedules, technical details, and extent of interference with other waterway traffic.

(5) *Bridges.* Type (material, construction, fixed or movable), location, use underbridge horizontal and vertical clearances at mean low water (MLW) and mean high water (MHW), type movable span (single or double swing, bascule, lift, central island turntable, retractile), and opening and closing times.

(6) *Safety gates.* Location, action of gates (mitering, lift, tainter), construction material and condition, and clearances.

(7) *Tunnels.* Location, length, horizontal and vertical clearances (seasonal), how vessels are powered through tunnel (towed, poled, pushed, self-propelled), minimum radius of curvature, and time required to traverse.

(8) *Shiplifts.* Location, dimensions of movable chamber, depth over sills of chamber, construction design and material, difference in water levels to overcome, time required to pass through the lift, special details of operation (power) and construction.

(9) *Inclined planes.* Location, construction (design and material, claylined, watered), hoisting device (hand-powered or mechanically powered), and passage time.

(10) *Passing basins and anchorages.* Location, size, depth, type of bottom, tppe and size of vessel berths, and controlling clearances.

(11) *Miscellaneous restrictions.* Location, details, and clearances, including power lines, telephone wires, cable crossings, mines, and other limiting features.

(12) *Waterway locks.* Information should include name, location, lifts, inside dimensions of chamber, depth over still, type of gates, time to fill anc clear, type of operating machinery, aids to navigation at lock approaches and approach structures.

(13) *Heavy floating machinery.* Dredges, yards, and construction materials, available for improving the waterway and its allied facilities.

(14) *Vessel repair facilities.* Location, character, and capacity of these facilities.

c. Inland Waterway Ports. Information should include:

(1) Identification of waterway: name or number.

(2) Name and location (coordinates) of port, map reference number.

(3) Approach channel: controlling depth and average width.

(4) Harbor: type, area, and depth.

(5) Berthage: type, construction material, total length, alongside depths, and width of apron.

(6) Storage space: warehouses (square feet of floor space), open (square feet of ground or floor space), bulk grain (bushels), cold (cubic feet), bulk oil (barrels).

(7) Cranes: total number and heaviest lift.

(8) Port clearance facilities: rail and highway.

(9) Date and source of information.

d. Features and Conditions Affecting Operations.

(1) Waterway traffic data:

(*a*) Average number, type, size, and capacity of vessels moving in each direction daily, monthly, and annually; passengers and tonnages transported; average net load; running time; speed; and vessel turnaround time by types.

(*b*) Running time and distance between all important points on waterway.

(2) Necessity for, pay, efficiency, and availability of local civilian pilots.

(3) Irrigation practices and effects on navigation water levels.

(4) Rules and regulations for use of waterway: those affecting rates; documentation; communication and dispatching; maximum permissible length, draft, beam, and load; maximum number of vessels, by type, normally permitted to use route in each direction.

(5) Construction and maintenance: responsible organization or agency; policies, procedures, and scope of activities; labor and administrative personnel.

(6) Principal users of waterway: identification and location, organization, vessels owned and operated, nature and volume of traffic.

(7) Incidence of traffic interruptions: type, cause, season, and area of occurrence.

(8) Navigational aids and towing facilities: location and type of buoys, bells, lights, etc.; availability of towing equipment and type (push, pull, alongside, shore).

C–3. Information Sources

a. Documents. Documents of the type described below are required for inland waterway transportation planning and intelligence purposes.

(1) *Hydrographic charts.* Charts of harbors show water depths, channels, islands, character of botton, berthing facilities, and aids and hazards to navigation. Hydrograpric charts show topography of the shore, including salient features that aid navigation and berthing. These charts are issued on national and local levels. They are supplemented by publications similar to "Sailing Directions," "Pilots," and "Tide Books."

(2) *Inland waterway terminal plans.* Inland waterway terminal plans are accurate, large scale drawings, or representations, showing the general overall layout with details of berthing, cargo handling, and storage facilities; beaches; feeder canals and tidal creeks; rail, road, and waterway connections and structures; and the location of important servicing installations and repair facilities.

(3) *Port publications.* Descriptive brochures are frequently issued by the port authority. The several companies operating the various installations at a port also issue brochures to attract business. In addition to these brochures, there are local chamber of commerce or board of trade statements and advertisements that point out advantages of a particular port.

(4) *Route logs, maps, and charts.* Such publications contain information concerning inland waterway locations, alinement, depths, lock characteristics, limits of navigability, crossings and overhead clearances, navigational aids and hazards, ports and landing areas, traffic bottlenecks, and other essential operating data, by mile or kilometer stations.

(5) *Craft census.* Inventories of harbor craft and floating equipment including lighters, tugs, powered vessels, barges, and construction and maintenance craft, such as icebreakers, floating pile drivers, dredges, draglines, and floating cranes.

(6) *Traffic studies and statistics.* Statistical analyses of port activities may be found in both national and local economic surveys, almanacs, and yearbooks. They furnish information on volume unloaded and loaded and provide a key to reception, discharge, storage, and clearance capabilities of the port as well as the number, type, draft, dimensions, and tonnage of vessels using the port during normal and peak traffic periods.

(7) *Guides to internal navigation.* Shipping registers; shippers' almanacs; national pilots; reports of inland waterway boards; and guides to internal navigation are publications which give information on inland and coastal waterway routes and their characteristics, ports, locks, and limiting factors shipping of all types including inland waterway, coastal waterway, and ocean shipping; and general operating rules, regulations, and procedures.

(8) *Documentation of freight.* Samples of shipping documents, bills of lading, rules for

marking containers, and related freight documentation material are of value for transportation planning and intelligence purposes.

(9) *Design and construction standards.* Basic standards for design and construction of port and inland waterway facilities and equipment may be found in engineering texts and governmental and equipment manufacturers' brochures. Such publications may contain information concerning national or regional standards for pier or guay construction, vessel and cargo handling equipment characteristics, transit storage facilities, lock construction, and other marine facilities.

(10) *Construction plans and progress reports.* Overall port and waterway improvement policy and programs; current and proposed port and waterway improvement plans including projects planned, completed, or underway; and dated progress reports on all such projects.

(11) *Aerial (vertical and oblique) and ground photographs.* Photographs are essential—particularly closeup views of wharves and cargo handling facilities and equipment; road, rail, and waterway clearance facilities and equipment; locks, vessels, transit storage, and vessel repair facilities; floating equipment; vessels working at alongside and anchorage berths; beaches and exits; and principal limiting structures. Vertical aerial photographs in stereoscopic pairs taken so as to provide scales of $\frac{1}{6000}$ to $\frac{1}{12000}$ provide sufficient detail to satisfy most requirements.

(12) *Tide and current tables.* Tide tables give the difference in water level at different points caused by tidal action. Current tables show the force and direction of currents within a waterway.

(13) *Hydrographic discharge graphs and tables.* Discharge graphs and tables show the volume of discharge, or volume of water (expressed in cubic feet or cubic meters per second) that passes a given point. Data usually show monthly discharge rates for an average year and for monthly peak periods.

(14) *Waterway profiles and cross sections.* These are scaled drawings which show the sectional differences in elevations of a waterway from a datum point, usually at sea level. Distances are generally expressed in miles or kilometers and elevations in feet or meters. Drawings range from simple, as for a natural stream, to very complex, as for the location of a complex of engineering works.

(15) *Lock tables.* Lock tables give location, length, and width of chamber; depth over sill: amount of lift; type of gates and number; and other data about the locks on specific waterways.

(16) *Structure plans.* These are scaled engineering drawings that give the structural characteristics and dimensions of construction projects. They are usually of dams, locks, and bridges.

(17) *Rules of the road.* All vessels are subject to nautical rules of the road. Inland and pilot rules prescribe procedures on inland or coastal waterways. Rules of the road govern the display of lights; fog, passing, and day signals; speed; buoyage system; and other vessel procedures.

(18) *Vessel diagrams.* These drawings or blueprints show the features or design characteristics of a particular craft. They are usually found in manufacturers' brochures and technical magazines.

(19) *Traffic flow charts.* These charts show tonnage movement on individual waterways or through ports.

(20) *Inland waterway directories and yearbooks.* Tables, listings, charts, and narrative material about the activities of governmental agencies responsible for inland waterway matters are often found in directories and yearbooks pertaining to inland waterways. These are published by both governmental agencies and private companies. These publications may also contain information on waterway characteristics, inland ports, individual operating companies, and associations of water transport operators.

b. Agencies.

(1) Port authorities.

(2) Construction and maintenance engineers and contractors.

(3) Statistical and inland waterway transportation bureaus.

(4) Ministries of transportation and public works.

(5) Commercial waterway carriers.

(6) Military planning and operating sections and units.

(7) Shipping companies, operators, employees.

(8) Waterway transport organizations.

(9) Governmental agencies comparable to U.S. Departments of Labor, Commerce, and Interior Bureau of Internal Revenue; Hydrographic Office; and Maritime Administration.

C–4. Estimating Movement Capability by Inland Waterway

The actual capacity of a waterway, the availability of craft, and the adequacy of terminal facilities are factors that must be considered when estimating inland waterway movement capability. Any of these factors may limit an inland waterway operation; each one must be examined to determine its impact upon the waterway movement capability. It is necessary, in the absence of definite information, to make certain assumptions when estimating inland waterway movement capability. The necessary assumptions, factors involved, and formulas for estimating movement capability are explained in this paragraph.

a. Assumptions. It is assumed that—

(1) Waterway is usable.

(2) Weather is favorable.

(3) Civilian use of the waterway has been restricted to essential traffic.

(4) Manpower and fuel are available and adequate.

(5) Vessels are weight-loaded to 80 percent of capacity.

(6) Average deadline rate is 20 percent.

(7) Waterway operations are 24 hours per day.

(8) Average speed is 4 miles per hour.

(9) Port operations are 20 hours per day.

(10) Cargo handling averages 30 tons per hour per barge.

(11) Average locking cycle is 45 minutes.

(12) Empties pass through the locks on the return trip.

(13) Effect of current is ignored.

(14) Cargo movement is only in one direction.

b. Waterway Movement Capability. There are two types of waterways—open and restricted. For the purpose of this discussion, lakes, rivers, channels, canals, and other navigable inland bodies of water that do not have locks or other restrictive features are termed "open waterways," whereas waterways that have locks or other restrictive features are termed "restricted waterways." Types of waterways and how to estimate movement capability over them are explained below.

(1) *Open waterways.* In general, open waterways can accommodate a large volume of traffic. The Mississippi River is an example of such a waterway: tows on the lower Mississippi and on the Ohio Rivers are usually a quarter of a mile long. Movement is limited only by availability of craft and adequacy of terminal facilities.

(2) *Restricted waterways.* An inland waterway that has locks or other restrictive features, such as narrow bridge spans or narrow passageways, is a restricted waterway. A passageway may be naturally narrow or narrowed by the number and/or width of bridge spans. Such restrictive factors may be the most limiting factor in an inland waterway movement. For example, if there is only one underbridge passageway, the safety factor betweem tows is the governing factor. (The safety factor between tows may vary from 1,000 to 2,000 feet.) Changing the number of tows per mile can make a great difference in movement capability.

(3) *Movement capability formulas.*

(*a*) *General.* The formulas given below may be used to determine movement capability over waterways. In these formulas and the formulas for determining barge and tug requirements discussed in *c* below, the letters used have the following meanings:

A = number of barges
B = tons per barge
C = percentage of usable barges
D = factor for military loading (This is the reduction factor that must be applied to each operation: it is determined by the loading and unloading of personnel, equipment, and facilities available).
E = one-way distance in miles
F = navigating-operating hours per day
G = average speed in miles per hour
H = actual load of one barge in tons
I = port-handling rate in tons per hour
J = length of port-working day in hours
K = number of locks
L = length of longest locking cycle in minutes
M = lock-operating hours per day
N = tows per mile
O = number of passages per day
P = daily tonnage requirement
Q = turnaround time in days for barges
R = number of barges per tow
S = turnaround time in days for tugs

(*b*) *Turnaround time.* The turnaround time in days for barges and tugs used in the formulas below is the sum of navigating time, port time,

and lock time. Methods of determining these times are:

$$\text{Navigating time} = \frac{E \times 2}{F \times G}$$

$$\text{Port time} = \frac{H \times 2}{I \times J}$$

$$\text{Lock time} = \frac{K \times L}{M \times 60}$$

(*c*) *Formula for open waterway.* A simple capability formula applicable only to open waterways is:

$$\text{Capability in tons per day} = N \times G \times F \times B \times D$$

(*d*) *Formula for restricted waterway.* When the waterway is restricted but the number of possible passages per day is known, a simple capability formula is:

$$\text{Capability in tons per day} = B \times O \times D$$

(*e*) *Formula for both open and restricted waterways.* If the number of possible passages per day is not known, but the basic information (information represented by the letters A through M in (*a*) above) is available, the following formula may be used to determine movement capability over an open or restricted waterway.

$$\text{Capability in tons per day} = \frac{A \times B \times C \times D}{\frac{E \times 2}{F \times G} \quad \frac{H \times 2}{I \times J} \quad \frac{K \times L}{M \times 60}}$$

Example: How many tons of military stores per day can be moved on a 300-mile waterway that has 10 locks if:

One hundred 1,000-ton capacity, self-propelled barges are available
The percentage of usable barges is 80
The factor for military loading is 0.6
Navigating-operating hours per day are 15
Average speed is 4 miles per hour
Load of each barge is 600 tons
Port-handling rate per hour is 30 tons
Length of port-working day is 20 hours
The locking cycle is 45 minutes
Lock-operating hours per day are 24

$$\text{Capability} = \frac{100 \times 1000 \times .80 \times 0.6}{\frac{300 \times 2}{15 \times 4} + \frac{600 \times 2}{30 \times 20} + \frac{10 \times 45}{24 \times 60}} = 3{,}902 \text{ tons per day}$$

c. Availability of Craft.

(1) *Barges.* Investigation must be made to determine if there are enough barges to perform the transportation mission. Barge requirements can be determined after the route capability is computed or the daily tonnage requirements are established. The formulas given below may be used to determine the number of barges required for open and restricted waterways.

(*a*) *Open waterway.*

$$\text{Barges required} = \frac{P \times Q}{B}$$

(*b*) *Restricted waterway.*

$$\text{Barges required} = O \times Q$$

(2) *Tugs.* When tugs are used, the arrangement of the tows must be considered. It is sometimes possible to operate with fewer tugs than barges because the tugs do not have to wait in port while the cargo is being transferred. Moreover, one tug can often tow more than one barge. In planning a towing operation, the fit of the tow in the locks must be considered. The following formula can be used to determine the number of tugs or towboats required to move the available barges.

$$\text{Number of tugs or towboats required} = \frac{R \times Q}{A \times S}$$

d. Adequacy of Terminal Facilities. Port facilities include berthing space and cargo handling equipment. Generally, these facilities do not constitute a restrictive factor in an inland waterway movement: usually mechanical handling facilities, general cargo can be handled at the rate of 10 tons per hour per barge. This capability can be greatly increased by using forklifts. If forklifts are used, it is safe to assume that 30 tons per hour per barge can be handled. Nevertheless, when existing port facilities are inadequate and it is not possible to improvise additional facilities, the existing port facilities may be the most restrictive factor in the entire movement. In such a case, the capability of port facilities will determine the inland waterway movement capability. This problem cannot be solved by using formulas; its solution requires careful analysis and sound judgment.

APPENDIX D

MOTOR TRANSPORTATION INFORMATION REQUIREMENTS

D–1. Areawide Information

a. Importance of Highways and Highway Transportation in the Country or Area.

(1) Place in the national economy; for example, relationship to industry, agriculture, and other modes of transportation.

(2) Relationship of the main highway system to secondary and tertiary road networks and to port, beach, and landing area facilities.

(3) Adequacy for country's peacetime and wartime transportation needs; potentialities for major improvement or development for military purposes.

(4) History of highway development and plans for future development.

b. General Description and Analysis of the Highway Transportation System.

(1) Geographical distribution of highways and highway transportation facilities.

(2) Small scale annotated maps, charts, and diagrams showing highway routes, route names and numbers, route lengths (in miles or kilometers), roadway surface types and widths, terminals, junctions, loading and unloading points, critical points, such as key bridges and other important features and facilities.

(3) Route classification and identification systems.

(4) Total highway mileage giving surface types and number of lanes.

(5) Surface types and road classification.

(6) General condition of the highway network, including an analysis of transport capacities, potentialities for military use, and principal limiting factors.

(7) Scheduling and status of current projects and proposed plans for the development or improvement of highways and highway transportation.

(8) Details of official construction standards and design specifications for highways, including roadways, bridges, ferries, fords, tunnels and other highway structures and facilities and an analysis of the extent to which standards are followed.

(9) Type and adequacy of route signs and a description of signs, markers, and special devices used.

(10) Density of the highway network by regions, in miles per square mile, and miles per unit of population.

(11) Description of the organization, training, operations, and capabilities of highway transportation units in the country's military service, including copies of tables of organization and equipment, field and technical manuals, and related literature.

(12) Explanations of local terms used in describing highways and highway transportation activities and resources.

c. Organization and Administration of Highways and Highway Transportation.

(1) Government policy, organization, and method of control.

(2) Identity, location, and organizational charts of agencies responsible for control and administration of highway transportation, and a discussion of functions and programs.

(3) Quantity and quality by departments and divisions of the skilled and unskilled labor force, centers where recruited, training and experience, working conditions and wage scales, and organization of highway personnel.

(4) Financial statistics: receipts, expenditures, and appropriations for highways and highway transportation.

d. Details of Repair, Storage, Parking, Fueling, and Other Highway Transport Service Facilities.

(1) Location and characteristics.

(2) Capacity, condition, and peacetime and wartime adequacy.

(3) Operating methods and problems.

(4) Personnel and special equipment employed.

(5) Fuel and lubricants in use, including type, source, method of distribution, and annual consumption.

(6) Source, availability, and adequacy of repair parts.

e. Details of Highway Transportation Activities.

(1) Government-owned -operated, or -controlled highway transport activities.

(2) Governmental control and regulatory measures: limiting axleloads; limiting vehicle lengths, widths, and clearances; and speed limits.

(3) Traffic flow charts and transportation statistics in the form of tabular and graphic presentations, indicating:

(*a*) Main truck and bus routes.

(*b*) Maximum number of vehicles, by types, operated over the various routes during normal and peak periods.

(*c*) Heaviest vehicles using particular routes, preferably in terms of maximum axleloads and frequency of heavy loads.

(*d*) Average freight hauled in net tons per unit.

(*e*) Statistics on passengers and cargo hauled, including ton-mile performance data and distances hauled.

(*f*) Traffic volume in urban areas; through and bypass routes.

(4) Major transport organizations:

(*a*) Location of main and field offices.

(*b*) Transportation units owned and operated by each.

(*c*) Operating facilities, personnel, and equipment owned by each.

(*d*) Bus or truck routes used.

(*e*) Efficiency of operations and maintenance in general and in terms of vehicles deadlined.

(*f*) Adequacy of transport operations for national needs.

(*g*) Prevailing passenger and freight rates.

(5) Analysis of the principal limitations of the areawide highway transportation system: overall traffic interruption statistics (urban area through-routes and street systems serving ports, landing areas, railroad junctions, airports, etc).

(6) Description and evaluation of highway transport communication facilities.

f. Motor Vehicle Characteristics and Inventory.

(1) *General purpose and combat motor vehicles.*

(*a*) Number, types, and makes of vehicles (trade name when applicable); use; source (foreign or domestic); annual report (to whom) and import (from whom) data; domestic production capacity and ability to meet area needs.

(*b*) General characteristics of each type vehicle: Net and gross weight, overall dimensions, cargo body dimensions, number and arrangement of wheels, number of driving wheels, tread and wheelbase, ground clearance, type of brakes, fuel tank capacity, and loading height.

(*c*) Performance characteristics of each type vehicle: maximum speeds and payloads for highway and cross-country; allowable towed-load; gradeability; cruising range, loaded and empty; POL for 100 miles when loaded; number of passengers.

(2) *Special purpose vehicles and equipment.* Number, by type, and the characteristics, capacities, and condition of the types of vehicles and equipment listed below.

(*a*) Vehicles used to carry outsize, odorous, explosive, corrosive, or contaminating cargoes; handling equipment for such cargoes.

(*b*) Vehicles such as bookmobiles, mobile post exchanges, mailtrucks, rail autocars, and engineer vehicles, such as cranes and bulldozers.

(*c*) Self-loading and unloading devices.

(*d*) Conversion kits used to modify vehicles.

(*e*) Vehicles and equipment used in arctic, desert, and jungle areas.

(*f*) Vehicles that operate on solid fuel.

g. Highway Transportation Research and Development Program.

(1) Research and development policy, trends, objectives, and capabilities.

(2) Testing and development centers, facilities, equipment, and key personnel.

(3) Current research and development projects and progress in the field of highway transportation, and important projects recently completed.

D–2. Detailed Description of Individual Routes

a. Route Identification and Description.

(1) Roadway name, number, length, and importance.

(2) Road type and classification.

(3) Details of important junctions, access and egress roads, bypass routes, and detours.

(4) Details of new construction or improvements planned or underway with dates.

(5) Tabular data concerning structures and crossings on the route (bridges, tunnels, underpasses, fords, ferries), including number, prevailing types, lengths, and load and clearance limitations.

(6) Distance between all important points.

(7) Location, length, and maximum interval between turnouts or passing places on one-way roads.

(8) An estimate of the operating capacity of the route based upon physical factors (para D–4).

(9) Obstructions, such as craters, roadblocks, mines, and destroyed culverts and bridges.

(10) Defiles and possible bypasses.

(11) Extent to which the capacity of the road is needed for normal civilian traffic and for civilian traffic deemed essential under theater policies.

(12) Visibility to enemy ground observers.

(13) Vulnerability to nuclear weapons.

(14) Traffic statistics: monthly and annual traffic data by type of vehicle—car, truck, bus, etc.; location, time, and duration of peak loads.

b. Highway Tunnels.

(1) *Location and identification.*

(*a*) Route name, number, and section.

(*b*) Name, number, or other identification.

(*c*) Coordinates and distance in miles or kilometers from an easily identified reference point.

(*d*) Nearest town identifiable on a map.

(*e*) Map and photographic references.

(2) *Characteristics.*

(*a*) Roadway surface type, condition, and traffic lanes.

(*b*) Truck traffic clearances, including usable roadway width, minimum vertical clearance, minimum radius of curvature, and maximum roadway gradient when warranted.

(*c*) Volume of traffic by type.

(*d*) Details of repair, storage, or parking facilities within tunnel or vicinity.

(*e*) Detours available and distances involved.

(*f*) Map, photographic, and basic document references, including design specifications, clearance or cross-sectional diagrams showing overall dimensions and minimum clearances for truck traffic.

c. Highway Fords.

(1) *Location and identification.*

(2) *Characteristics.*

(*a*) Alinement, gradient, and condition of banks and approaches.

(*b*) Length of ford or width of streambed.

(*c*) Roadway surface type, usable width, traffic lanes, and conditions.

(*d*) Depth of water and velocity of current at different seasons when usable. (Good fords have less than 2-foot water depths and a current less than 3 miles per hour.)

(*e*) Limiting factors (load and speed restrictions, etc), normal crossing time, and periods unusable.

(*f*) Detours and alternate crossing sites, including evaluation of streambed above and below the ford.

(*g*) Map and photographic references, plans, charts, and diagrams.

d. Ferries and Ferry Facilities.

(1) *Location and identification.*

(2) *Route details.*

(*a*) Name of terminals and water distances between them.

(*b*) Possible alternate routes or crossing points.

(3) *Characteristics and inventory.*

(*a*) Name, age, and condition of ferries in service, including statement of capacities in short tons and in number of passengers and vehicles, by sizes, that can be accommodated.

(*b*) Technical details of ferry, including length, beam, and draft; motive power and horsepower for each unit; fuel type, capacity, and source; and method of unloading (side or end).

(*c*) Number, type, and efficiency of operating personnel.

(*d*) Largest and heaviest vehicles or loads handled and techniques employed.

(4) *Traffic statistics.*

(*a*) Crossing time (light and loaded) and roundtrip crossing time, including loading, unloading, and docking time.

(*b*) Periods not operational and causes.

(5) *Terminal facilities.*

(*a*) Operating capacity and limiting factors, including references to handling, storage, fueling, repair, maintenance and loading or clearance facilities, and equipment and personnel.

(*b*) Potentialities for military transportation use.

e. Equipment and Facilities for Crossing Streams and Rivers.

(1) *Floating equipment.*

(*a*) *Individual.* Individual equipment is that worn or used by individuals to provide buoyancy and propulsion. Information should include:

1. Physical characteristics: shape, size, material, weight, dimensions.

2. Type of propulsion: oars, flippers on feet, paddles, small motors.

3. Means provided to prevent equipment from filling with water (air, cork).

4. Quantity of equipment and trained personnel available.

(*b*) *Floating bridges.* Information should include: load capacity, width, length, type of roadway, maximum speed and vehicle spacing.

(2) *Fixed Facilities.*

(*a*) *Bridges.*

1. Types and characteristics. There are many types of bridges, but those most commonly found are stringer, girder, suspension, and truss (fig. D–1). The main characteristics of these bridges are described below.

(a) *Stringer.* This type consists of two main parts: substructure and superstructure. The substructure is built of end supports, called abutments, and intermediate supports, called bents or piers. The superstructure consists of stringers (longitudinal members spanning the distance between intermediate supports or abutments) and the flooring.

(b) *Girder.* A girder bridge is one on which the roadway loads are transmitted from the floor system to the abutments, or piers, by steel or iron girders. Girders are of two basic types—plate and truss. A plate girder has a solid web. It may consist of an I-beam or may be built of plates, angles, and channels. A truss girder has an open structural framework composed of angles, bars, and channels.

(c) *Suspension.* A suspension bridge has the roadway suspended from two cables that are passed over the tops of two towers and secured to anchorages on each bank. The floor beams are supported by vertical cables, called slings, suspended from the main cables. The stringers rest on the floor beams.

(d) *Truss.* This type of bridge is used for long spans where a suspension bridge is not feasible. The truss is a compound beam in which the parts are arranged to form one or more triangles in the same plane. Roadway loads are transmitted from the bridge flooring to the abutments and intermediate supports.

2. Collecting and reporting information. Information on bridges should include:

(a) Location and structural type; name of stream spanned.

(b) Class (FM 5–36); use—vehicular or footbridge.

(c) Number of lanes and widths of each; separate walkway.

(d) Spans: number, length, length of panels, anchoring methods.

(e) Abutments: type, material, dimensions.

(f) Intermediate supports: type, material, number, location, spacing, sizes and placement of members.

(g) Stringers: number per span, type, material, size, spacing.

(h) Flooring: type, material, roadway clearance, thickness, number of layers (for plank floor), and thickness and direction of each layer.

(i) Physical condition of the structure and apparatus, including condition of welding, rivets, bolts.

(j) Approaches.

(k) Vulnerability of bridge to damage by flood or ice, including possible flanking of abutments by erosion.

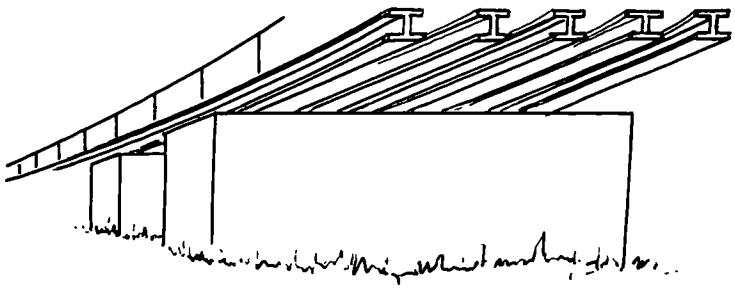
(l) Type of soil in stream or gap and around abutments.

(m) Safety and security features.

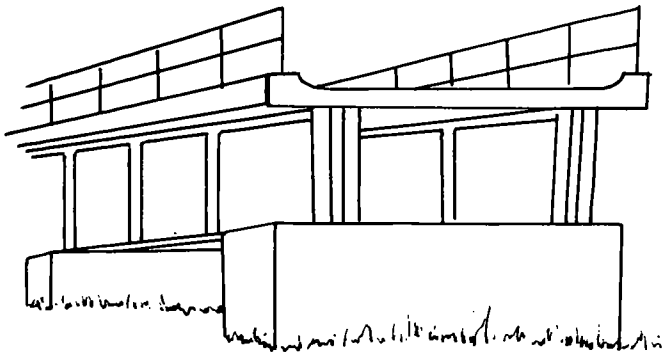
(n) Bypass conditions.

(o) What is need for major repairs or improvements.

(p) Drawbridges: type and dimensions; clearance width(s), allowing for fenders and for navigation of passageway; clearance



STEEL STRINGER



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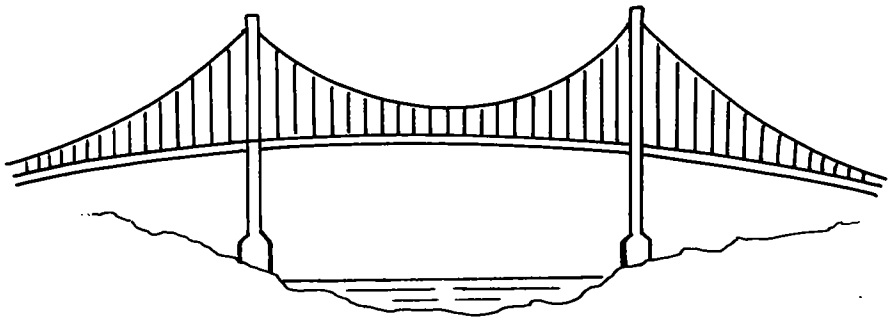
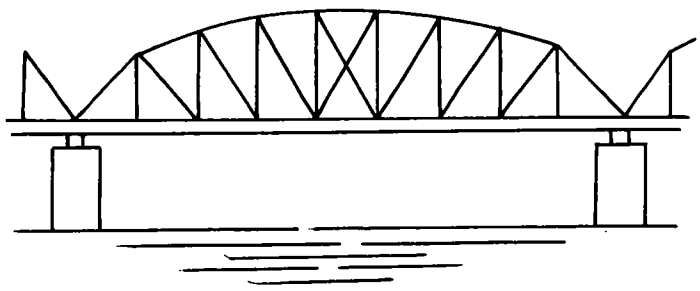


SUSPENSION



TRUSS

Figure D–1. Common types of bridges.

height of lift spans when raised (specify stage of river); details of operating machinery; practicability of hand operation, including time required to open and close; time required to open and close by machinery; how frequently it would have to be opened to handle water traffic deemed essential under theater policies; availability of trained and trustworthy operators.

(*b*) *Cableways.* A cableway is used to cross obstacles if other methods are impractical because of high banks, swiftness of current, or conditions which may be encountered in mountainous terrain. A cableway consists of a track suspended between two towers and anchored behind each tower. The traveling carriage, which is the load carrier, is suspended from the track cable and is usually drawn back and forth across the span by a cable attached to a power unit. Information should include anchoring equipment for the main cables, capacity of carriage, speed with maximum load, and type of drive and hoist units provided.

f. Traffic Bottlenecks. Information about traffic bottlenecks and potential areas of congestion should include facts about:

(1) Highway and road tunnels.

(2) Narrow roads and streets, including those which can only handle one-way traffic.

(3) Sharp curves and switchbacks.

(4) Steep grades and long grades, including poor-traction areas.

(5) Overpasses and underpasses.

(6) Fords and ferries.

(7) Minimum clearances.

(8) Detours available.

(9) Flood conditions and other conditions related to weather.

(10) Defiles.

(11) Narrow bridges and weak bridges.

g. Terrain. Terrain is of primary importance when evaluating the enemy's ability to effectively move persons and things by motor transportation. When obtaining information, consideration should be given to:

(1) Concealment and cover available from vegetation or other terrain features, including covered routes of communications.

(2) Natural and artificial obstacles.

(3) Topography and hydrography.

(4) Drainage and relief.

(5) Surface materials and surface conditions or roads and bivouac areas.

(6) Effect of weather on surface, such as flooding and freezing.

(7) Cross-country trafficability.

(8) Landing and drop zones available.

(9) Geology and hydrology of the area.

(10) Location, size, and characteristics of urban areas.

(11) Characteristics of beaches and other landing areas where motor transport will operate.

D–3. Information Sources

Information needed for producing highway intelligence data and for highway transportation planning can be obtained from the following documents and agencies.

a. Documents. Valuable information can be obtained from the documents discussed below.

(1) *Highway maps.* Highway maps, town plans, and atlases contain information concerning route location, alinement, width and mileages, type of road and surface, traffic lanes, interconnections, principal towns, terrain features, and other data. Usually maps can be obtained from public works departments or commercial agencies.

(2) *Route logs.* Detailed route descriptions, by mile or kilometer post locations, which provide data concerning type, base, and shoulders; bridges, tunnels, fords, and ferries; bottlenecks of all types; overhead clearances; radius of curves; gradients; sight distances; repair and servicing facilities; and similar data.

(3) *Traffic surveys.* Studies of traffic patterns: an analysis of traffic characteristics, variations in traffic flow, and the classification of highway traffic by types of vehicles. Data should provide basic information about the number of vehicles that travel a highway, vehicle sizes and speeds, truck weights and capacities, frequency of maximum loads, and recurring high volume traffic.

(4) *Traffic flow chart.* This is a chart that shows the average traffic movement over various routes during a given period of time. These traffic movements are drawn to scale by using lines of varying widths. The average daily number of vehicles carried by individual routes is shown. The figures are usually based on one-day, periodic, continuing, or seasonal traffic counts at various locations in rural and urban areas.

(5) *Traffic studies.* These include truck weight studies which show truck distribution by types, average loaded weight of trucks by types,

trends in vehicle weights and speeds, routes used, and correlation of this information with pavement performance data.

(6) *Traffic laws and regulations.* Traffic rules and regulations are often published in booklet or pamphlet form. These publications contain: illustrations and explanations of traffic control signs and signals, pavement markings, turning controls, curb-parking controls, traffic routing (one-way street systems, truck and bypass routes), extent of standardization, and accident rates.

(7) *Classification plan.* This plan designates roads and streets that have similar characteristics and perform similar functions as separate systems —for example, federal, state, and local. These distinct systems may be assigned to different governmental agencies for administration. Mileages, volume, and percent of traffic by road or street class may be indicated.

(8) *Engineering texts, booklets, pamphlets, and government publications.* These publications contain information concerning national or regional standards for surface and base materials, widths, and thicknesses; shoulder widths; passing-sight distances; intersections; radius and superelevation of curves; percent of grades; overhead clearances; speeds; bridge ratings; control of access; axleloads; capacities (ability to accommodate traffic); and similar essential transport operations data.

(9) *Manufacturers' publications.* These publications contain information concerning regional and national standards for dimensions, weights, speeds, and axle and wheel loadings of vehicles.

(10) *Vehicle inventories.* Inventories should show available operating equipment, giving total number of vehicles by types and details about size, body type, cargo-carrying capacity, fuels used, performance characteristics, operating condition, use, and other data.

(11) *Operating schedules and statistics.* This type of information includes: passenger, bus, and truck transport schedules; general operating rules and regulations; routes of movements; data concerning operating personnel, facilities, and equipment; transport operations statistics, including number of passengers and ton-miles of freight hauled during given periods.

(12) *Construction plans and progress reports.* These are reports on overall highway improvement, including projects planned, completed, or underway; plan and elevation drawings of principal roadway structures; and diagrams showing typical cross-sectional views of the roadway.

(13) *Aerial and ground photographs.* Photographs are essential. Particularly valuable are closeup views of typical highway features depicting roadway surface and widths, bottlenecks of all types (sharp curves, steep grades, narrow bridges, fords, underpasses), and principal structures (app H).

(14) *Special equipment inventories.* Inventories of construction equipment should include type and make, details about size, capacity, fuels, performance characteristics, etc.

(15) *Design and specification standards.* Design and specification standards for roads, highways, and tunnels are usually published by the ministry of public works or the ministry of transportation. Additional information may be found in technical engineering publications and textbooks.

(16) *Organizational charts.* These charts show the organizational structure of the ministry or agency in control of the highway network.

b. Agencies.

(1) Public works office.

(2) Highway resident and field offices, and transport control organizations.

(3) Road maintenance crews.

(4) Ministry of transportation or its equivalent.

(5) Truckers associations.

(6) Trucking and transit firms.

(7) Tourist bureaus.

(8) Major oil companies.

(9) Bookstores and libraries (for yearbooks, maps, travel folders, transportation statistics, etc).

(10) Civil transportation and engineer planning and operating units.

(11) Road associations—usually affiliated with the International Road Federation.

(12) Traffic control authorities, including local or national police forces—often under the ministry of interior.

(13) Vehicle manufacturers.

D–4. Estimating Highway Capability

a. General. The capability of a highway to support either a normal or a maximum vehicular

movement is determined by a number of factors: surface type, width of surface and shoulders, curves and gradients, moisture, number of traffic lanes and operational factors. No one highway movement is apt to be affected by all these basic factors. Conditions dictate the factors which must be used when estimating a highway's capability. FM 55–15 provides comprehensive guidance on how to estimate highway capability for movement of all types of military vehicles. A less comprehensive but workable method for determining the capability of a highway is explained in *b* and *c* below. This method is based on the assumption that the highway bridges are adequate, or will be improved, to carry the estimated capabilities.

b. Basic Factors.

(1) *Surface type.* Roads are grouped into types, each type having a basic maximum capacity. The various types of road surfaces with their basic and operational capacities are shown in table D–1.

Table D–1. Highway Daily Capacity: Basic and Operational

Vehicle type	Surface type	Average speed (mph)	Vehicle interval (ft)	Capacity in vehicles per 24 hours for all traffic[1]	
				Basic	Operational[2]
3-ton cargo truck	Cement concrete, bituminous concrete, intermediate bituminous, and bituminous surface treated.	25	300	21,100	16,900
	Waterbound macadam, gravel, and crushed stone.	20	600	8,400	6,700
	Improved earth.	20	800	6,300	5,000
	Unimproved earth.	10	1,000	2,500	2,500

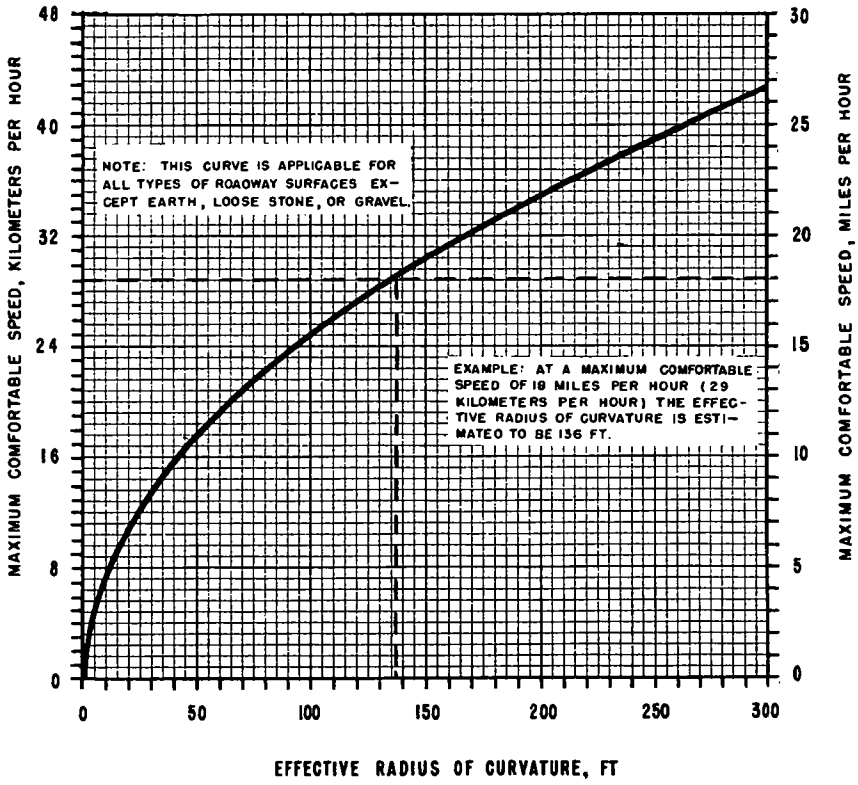
[1] Capacities are based upon assumptions that drainage and thickness of base are adequate.
[2] Operational capacity is approximately 80 percent of basic capacity.

(2) *Surface and shoulder width.* For a two-way movement, the ideal highway is 24 feet wide and has shoulders at least 7 feet wide. The shoulder factor should not be ignored, but it should be considered only as a means of maintaining maximum capacity rather than as a means of increasing capacity. If there are no shoulders or if they are less than 7 feet wide, a reduction factor should be used. Table D–2 gives surface and shoulder width factors.

Table D–2. Surface and Shoulder Width Factors

Type of movement	Number of lanes	Surface			Shoulder		
		Width (ft)	Factor		Width (ft)	Factor	
			Divided highway	Undivided highway		Divided highway	Undivided highway
One-way	1	8–11	- - - -	0.5	0–2	- - - -	0.8
	- - -	- - -	- - - -	- - - -	2–7	- - - -	0.9
	1	12–17	- - - -	0.6	7–12	- - - -	1.0
Two-way	2	18–20	- - - -	0.8	0–2	- - - -	0.8
	2 or 3	21–23	- - - -	0.9	2–7	- - - -	0.9
	2 or 3	24	- - - -	1.0	7–12	- - - -	1.0
	4	36	2.0	1.8	0–2	0.8	0.8
	4	42	2.2	2.0	2–7	0.9	0.9
	4	48	2.5	2.2	7–12	1.0	1.0

(3) *Curve and gradient (fig. D–2).* Curves and gradients affect the capacity of roads. Curve and gradient factors applicable to undulating, hilly, and mountainous areas are shown in table D–3. Radius of curvature is measured from the center of the circle to the middle of the road. Gradient, or slope percentage, is the ratio of the vertical rise to the horizontal distance traveled.



MAXIMUM COMFORTABLE SPEED: SPEED AT WHICH CENTRIFUGAL FORCE INITIALLY CAUSES THE DRIVER OR PASSENGER TO FEEL AN UNCOMFORTABLE SIDE PITCH OUTWARD.

EFFECTIVE RADIUS OF CURVATURE: RADIUS OF AN EQUIVALENT HORIZONTAL CURVE HAVING NO SUPERELEVATION (BANKING).

Figure D–2. Estimating highway curve radius.

Table D–3. Curve and Gradient Factors

Terrain	Curve, minimum radius (ft)	Gradient		
		Percent	Horizontal-vertical ratio	Factor
Undulating	150	3 to 5	33–1 to 20–1	0.9
Hilly	100	Over 5 to 7	Steeper than 20–1 to 14–1	0.8
Mountainous	50	Over 7	Steeper than 14–1	0.6

(4) *Moisture.* Moisture has an important bearing on the capacity of road surfaces to withstand sustained vehicular movement. Heavy concentrations of or long exposure to moisture affects the subsoil of even the highest type pavement. Both the surface and subsoil of low type or unimproved roads are immediately affected. The degree of moisture can be determined by studying data on soil conditions and on seasonal variations in weather. Tables D–4 and D–5 may be used as guides in determining the effect of moisture on the capacity of a highway to withstand sustained and maximum vehicular movement. Reports of good, fair, and poor surface conditions have to be evaluated by the analyst. He must compare them with other reports, photographs, and information about the road network.

Table D–4. Factors Used to Determine Effect of Moisture on Highway Capacity

Surface type	Condition of road								
	Good			Fair			Poor		
	Dry	Moist	Wet	Dry	Moist	Wet	Dry	Moist	Wet
Cement concrete, bituminous concrete	1.0	1.0	0.9	1.0	1.0	0.8	0.9	1.0	0.7
Intermediate bituminous	0.9	1.0	0.8	0.9	0.9	0.6	0.8	0.9	0.4
Bituminous surface treatment	0.6	0.7	0.3	0.6	0.7	0.2	0.3	0.4	0.1
Waterbound macadam, gravel, crushed stone	0.4	0.6	0.2	0.3	0.5	0.1	0.2	0.4	0.05
Improved earth	0.3	0.6	0.2	0.3	0.5	0.1	0.2	0.4	
Unimproved earth	0.3	0.6	0.2	0.3	0.5	0.1	0.2	0.3	

Table D–5. Numbers of Days Surfaces Can Support a Maximum Movement

Surface type	Condition of road								
	Good			Fair			Poor		
	Dry	Moist	Wet	Dry	Moist	Wet	Dry	Moist	Wet
Cement concrete, bituminous concrete	30	30	30	30	30	30	20	20	20
Intermediate bituminous	15	15	15	15	15	15	10	10	5
Bituminous surface treatment	10	10	5	10	10	5	5	5	1
Waterbound macadam, gravel, crushed stone	5	5	1	5	5	0.5	2	2	0–0.25
Improved earth	5	5	0.5	5	5	0–0.25	2	2	
Unimproved earth	5	5	0.5	2	2	0–0.25	0–0.25	0–0.25	

(5) *Number of traffic lanes.*

(*a*) *One lane.* Roads less than 18 feet wide can be used only for one-way movement; therefore, the whole adjusted sustained capacity is in one direction. To maintain this type of movement over a period of time, alternate routes for return of empties must be available or the hours of operation must be reduced to allow for the return of empty trucks. The one-way factors shown in table D–2 are sufficiently small to reduce capacities from two lanes to one lane.

(*b*) *Two lanes.* Roads over 18 feet in width can support one-way or two-way movement. Since the capacities shown in table D–1 are for all traffic, the adjusted capacity will be in terms of total traffic moving in both directions for two-way movement. Half of this total two-way movement therefore represents the highway capacity in one direction.

(*c*) *Multilane.* A multilane, divided highway of a given width can support a greater volume of traffic than an undivided highway of the same width because all traffic on any one lane is moving in the same direction. Since total traffic may move in one or both directions, the adjusted capacity may be determined in the manner described in (*b*) above. The greater capacity of multilane systems is allowed for in table D–2.

(6) *Operational.*

(*a*) *Turning and cross movements.* Although the turning and cross movement factor varies between 1.0 and 0.5, according to the size and nature of the overall operation, the average factor of 0.85 may be used when estimating highway capacity.

(*b*) *Hours of running time.* Running time may be determined by the hours of daylight or darkness. The running time selected should in no case exceed 18 hours a day for a sustained movement. When planning a one-way movement over a route for which no alternate is available, the running time selected must include time for returning empties and for turning around.

(*c*) *Weather and other factors.* Certain operational factors, such as the weather and the tactical situation, cannot be accurately assessed beforehand.

c. Making the Estimate.

(1) *General.* No one highway or movement is apt to be affected by all the basic factors described in *b* above. Conditions dictate the factors which must be used when estimating a highway's capacity. The analyst must consider each problem separately. In some situations, a factor of 1.0 will apply: in such cases, the operational capacity is not affected. Methods and examples of estimating highway capacity to support normal and maximum movements are given below.

(2) *Methods.*

(*a*) *Normal movement.* To make a highway capability estimate, determine surface type and multiply the operational capacity in number of trucks (table D–1) successively by each of the following factors that is applicable: width of surface and shoulder, curve and gradient, moisture. The figure thus obtained will be for a 24-hour day; adjust this figure to reflect the actual working hours in the day by multiplying it by the following fraction:

$$\frac{\text{Working hours in day}}{24}$$

Adjust the figure further to show movement in one direction only by dividing by 2 if a two-way movement. If movement is one-way, no further reduction is necessary since surface width factor provides for one-way movement. Convert to tonnage capability.

(*b*) *Maximum movement.* To estimate the capability of a highway to support a maximum movement, multiply the basic daily capacity successively by the surface and shoulder width factors, the curve and gradient factor, and the turning and cross movement factor. Although the moisture factor is not used as a multiplier in making a maximum movement estimate, the number of days the highway can support a maximum movement under varying degrees of moisture must be considered. Adjustments of the figure thus obtained are made in the same manner as for the normal movement described in (*a*) above except that the working day is 20 hours. Owing to the influence of the surface on such movements when no road maintenance is performed, high type surfaces can sustain movements for longer periods than low type surfaces (table D–5).

(3) *Examples.*

(*a*) *Bituminous surface treatment.*

1. Problem. What is the sustained capability of a bituminous surface treated highway

where surface is 12 to 20 feet wide and in fair condition
shoulder width is 6 to 7 feet
maximum gradient is 10 percent
minimum curve radius is 100 feet
it is the dry season

alternate routes are available for the return of empty trucks
operations will be 12 hours per day
three-ton trucks will be used.

2. Solution. The operational capacity for 3-ton cargo vehicles on bituminous surface treatment is 16,900 vehicles per day (table D–1). Inasmuch as surface widths vary from 12 to 20 feet, the estimate must be for a one-way movement. The returning empty trucks will use alternate routes. The surface width factor (table D–2) is 0.6 for a 12-foot surface; the shoulder factor is 0.9. The curve and gradient factor for 10 percent grades is 0.6 (table D–3). The moisture factor is 0.6 for bituminous surface treatment in dry weather and fair condition (table D–4). The average factor for turning and cross movement is 0.85. Therefore, the calculation for this estimate is 16,900 x 0.6 x 0.9 x 0.6 x 0.6 x 0.85 or 2,793 vehicles per day. Multiplying the number of vehicles by 3 (the average payload in short tons carried by each vehicle) gives a highway capability of 8,379 short tons per 24-hour day for a sustained period. Since the operation is only for 12 hours per day, the net capability is one half of 8,479 or 4,190 short tons per day. It should be noted that this problem involves a 12-hour, one-direction movement because alternate routes are available for the returning empties. Had no alternate routes been available, the running time, which must include time for changing direction and returning empties, might have been 8 hours forward, 8 hours returning, and 2 hours for transition. This makes a total of 18 hours per day, which is the recommended maximum for sustained movement.

(*b*) *Gravel surface.*

1. Problem. What is the sustained capability of a gravel-surfaced road

where surface is 18 feet wide and in poor condition
shoulder width is 2 feet
maximum gradient is 10 percent
minimum curve radius is 200 feet
it is the wet season
no alternate routes are available
operations are for 14 hours per day
three-ton cargo trucks will be used

2. Solution. The operational capacity of a gravel surface to support 3-ton cargo trucks is 6,700 vehicles per day (table D–1). A two-way movement is planned because the surface is 18 feet wide and no alternate routes are available. According to table D–2, the surface width factor is 0.8; the shoulder width factor is also 0.8. The curve and gradient factor is 0.6 (table D–3). Table D–4 shows the moisture factor to be 0.05 for a wet gravel road in poor condition. The factor of 0.85 is used for turning and cross movement. The calculation for this estimate is 6,700 x 0.8 x 0.8 x 0.6 x 0.05 x 0.85 or 110 vehicles per day with vehicles traveling in both directions. Therefore 110 divided by 2 will give 55 vehicles for a one-direction movement. Then 55 times 3 (average number of tons carried by each vehicle) equals a capability of 165 short tons per 24-hour day. Using a 14-hour working day, the net capability is fourteen twenty-fourths of 165 or 96 short tons per day for sustained operations.

(*c*) *Four-lane, divided highway.*

1. Problem. What is the sustained capability of a four-lane divided highway

where surface is cement concrete in fair condition
width of each two-lane section is 24 feet
shoulders are 7-feet wide
maximum gradient is 4 percent
minimum curve radius is 1,000 feet
the weather is dry
operations will be for 12 hours per day
three-ton cargo trucks will be used

2. Solution. Use the operational capacity of 16,900 vehicles per day for a cement concrete surface as the basic figure for the computation (table D–1). The surface width factor for a 4-lane, divided highway with two 24-foot surfaces is 2.5 and the shoulder width factor is 1.0 (table D–2). The curve and gradient factor (table D–3) is 0.9 for 4-percent grades. The moisture factor for fair cement concrete in dry weather is 1.0 (table D–4). The average factor for turning and cross movement is 0.85. Thus the calculation for sustained movements on this section of highway is: 16,900 x 2.5 x 1.0 x 0.9 x 1.0 x 0.85 or 32,321 vehicles. This figure represents the number of vehicles per 24-hour day that is the practical total capacity of the highway. Since returning empty trucks will use the highway also, the cargo movement forward will be one half of the capacity. Therefore the traffic in one direction will be 16,160 vehicles per day. Because operations are for only 12 hours per day, 16,160 must be divided by 2 which gives a net capacity in one direction of 8,080 vehicles per day. The sustained capability in tonnage will be 8,080 x 3 or 24,240 short tons per day.

(*d*) *Maximum movement over four-lane, divided highway.*

1. Problem. What is the maximum movement capability of the four-lane, divided highway described in (*c*) above?

2. Solution. Procedure is the same as that outlined in (*c*) above except basic capacity is used instead of operational capacity (table D–1), the moisture factor is not considered, and running time is increased to 20 hours per day. The computation is 21,000 x 2.5 x 1.0 x 0.9 x 0.85 or 40,162 vehicles per 24-hour day traveling in both directions. Since operations are for 20 hours per day and only forward traffic is desired, 40,162 times twenty twenty-fourths divided by 2 would give 16,734 vehicles per day forward. The net short term tonnage capability is then 16,734 x 3 or 50,202 short tons per day. This capability for cement concrete in fair condition could be maintained on a maximum basis for 30 days (table D–5).

APPENDIX E

PORT, BEACH, AND LANDING AREA INFORMATION REQUIREMENTS

E–1. Areawide Information

Information requirements of a general nature about an area should include facts about the topic outlined below.

a. Importance of Ports, Harbors, Beaches, and Landing Areas.

(1) Place of water terminal facilities in the national economy, including relationship to industry, agriculture, and other components of the transportation network.

(2) History of water terminal development and influencing factors.

(3) Adequacy of water terminal facilities for country's peacetime and wartime transportation needs; potentialities for major improvement or development for military purposes.

b. Description and Analysis of the Water Terminal Facilities Complex.

(1) Small scale annotated maps, charts, and diagrams indicating the location of ports, harbors, baaches, and landing areas; critical features of anchorage areas, channels, breakwaters, and vessel berths; heavy lift, storage, servicing, repair, and clearance facilities; and mileages between all important locations.

(2) Discussion of official construction standards for water terminal facilities and the extent observed. Location, organization, and scope of activities or agencies in charge of construction and maintenance.

(3) Details of the status and scheduling of current projects and proposed plans for the development, improvement, or standardization of water terminal facilities.

(4) Summary analysis of the operating condition, limitations, capacity, and military potentialitss of ports, harbors, beaches, and landing areas in the country.

(5) Details of the organization, training, operations, and capabilities of water terminal operating units in the military service, including tables of organization and equipment, field and technical manuals, and related training literature.

(6) Explanation of local terms used in describing ports, harbors, beaches, landing areas, and related transportation activities and facilities.

c. Organization and Administration of Water Terminal Facilities.

(1) Ownership, funding, governmental regulatory controls; nature and extent of foreign influence and interests.

(2) Location, organization, and functions of agencies responsible for control and administration of water terminal activities at national, regional, and local levels.

(3) Number of water terminal administrative personnel by departments and divisions and their training, education, technical qualifications, and efficiency.

(4) Size and quality of the skilled and unskilled labor force, centers where recruited, training and experience, working conditions, wage scales, attitudes toward Americans—unfriendly and sympathetic elements.

(5) Availability and number of harbor pilots.

(6) Financial statistics, shipping and stevedoring rates, oprating revenues and expenses, and foreign financial aid received for water terminal development.

d. Water Terminal Operations Data.

(1) Operating regulations, methods, and standards for freight and passenger traffic; methods of documentation and containerization.

(2) Operating statistics tabulated and analyzed for each port and for the water terminal complex as a whole, including—

(*a*) Methods of and special regulations affecting cargo handling and transfer.

(*b*) Average cargo handling rates by types

of cargo (inbound and outbound), annually, monthly, daily, and hourly.

(*c*) Average daily tonnages by types of cargo, e.g., containerized, palletized, loose general, and vehicles, worked alongside and by lighter.

(*d*) Average turnaround time for conventional cargo vessels, containerships and tankers.

(*e*) Total net register tonnage and number of vessels, by size, type, and draft calling at the country's ports yearly.

(*f*) Maximum permissible length, draft, beam, and load for vessels using the ports and landing areas; length and draft of largest ship regularly visiting the port.

(*g*) Average daily tonnages by commodities, including containers, handled by principal loading, unloading, and transfer points within particular port areas.

(*h*) Maximum number of vessels by type, size, and draft that can be berthed and worked simultaneously at alongside berths and in the stream. Estimated future traffic increases.

(*i*) Estimate by military planners, port authority, or other competent source of the maximum daily cargo tonnage that can be unloaded from ships and cleared from the port area daily by rail, highway, air, inland waterway, and pipeline. Factors that can be used in developing the estimate are: number, size, type, and draft of vessels being worked simultaneously at alongside berths and in the stream; number, capacity, and speed of lighters available; length of working day; methods of transfer (by cranes or ships' gear); and type of cargo handled.

(*j*) Estimate of maximum daily tonnage that can be outloaded.

e. Water Terminal Operations Research and Development (Civil and Military).

(1) Research and development policy, funding, objectives, and capabilities.

(2) Testing and development centers, facilities, equipment, and key personnel.

(3) Current water terminal research and development projects and progress.

E–2. Detailed Description of Individual Ports, Harbors, Beaches, and Landing Areas

a. Identification. Give name, location, and characteristics. Identification should state whether an open roadstead, partly inclosed bay, landlocked harbor, sheltered area behind barrier reef, estuary, river, canal, or lake.

b. Description.

(1) *Approaches and entrances.* Usual method of approach and alternate means; natural protection, breakwaters, jetties; entrance channel length, controlling width and depth; maximum length, beam, and draft of largest vessel which can enter; extent of dredging required; navigational hazards and necessity for pilotage; outer bar if any (location, width, depth, tendency to shift and shaol); inner channel characteristics; equipment locally available for channel maintenance and improvement; and ice conditions.

(2) *Tides and tidal currents.* Tidal rise and range including heights of high and low water, springs and neaps; and rate and direction of tidal streams and currents.

(3) *Weather.* Description of weather conditions that might affect cargo loading and discharge acitivities.

(4) *Anchorages.* Details of all anchorages or potential anchorages; depths of water; approach channels; shelter afforded; wind, wave, and current conditions; type of bottom and holding ground; mooring installations; and number and type of vessel berths.

(5) *Harbor.* Description of locks, bridges, mooring buoys, ferry services, power stations, breakwaters, wet docks, and semitidal basins; location in relation to town or coast; general form and type; framework and component parts; aids to navigation; pilotage; shores adjoining harbor.

(6) *Beaches and landing areas.* Because of the importance of beaches and landing areas in amphibious operations, detailed information is needed about:

(*a*) Hydrographic conditions (fig. E–1).

1. Depth of water along shore. Depth of water from a predetermined seaward limit to the beach.

2. Sea bottom. The nature, profile, and consistency of the sea bottom from the predetermined seaward limit to the beach at lowest low water, including whether it is sand, shell, shingle, rock, mud, gravel, coral, silt, etc.

3. Surf. The distance from shore that the line of breakers forms, average height of breakers from crest to trough, type and number of lines of breakers, including period, width of the surf zone, and angle at which the surf strikes the shore.

4. Currents. The location, type, direction, and speed of offshore and inshore currents, includ-

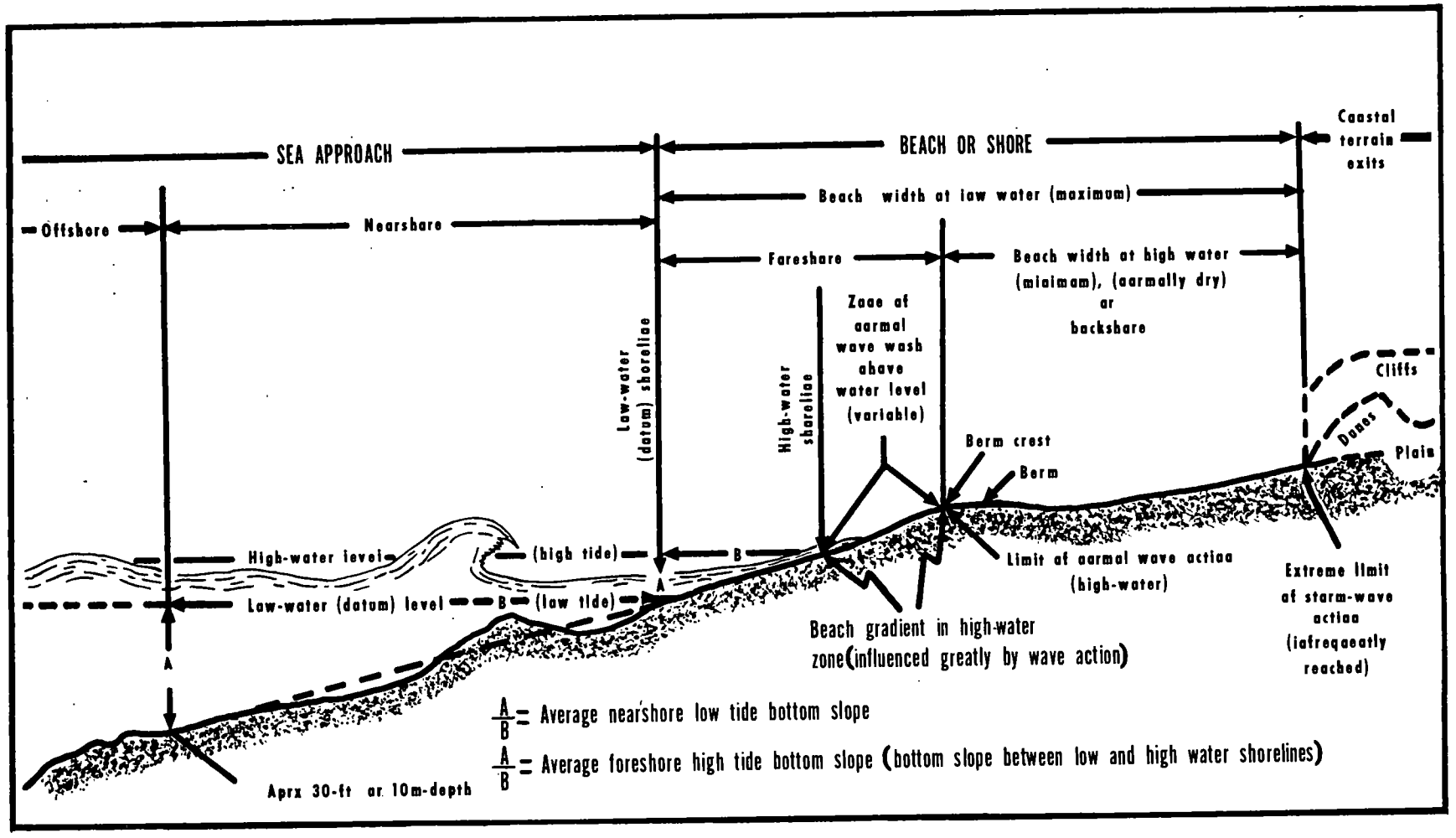


Figure E-1. Beach profile diagram.

ing dangerous sea conditions, such as rips and undertows.

5. Tide. The tidal range and period, including the duration and variation of high and low water and the effect of tide upon beach width.

(*b*) *Offshore natural obstacles.*

1. Reefs. The width; length; slope; height above or depth below water at various tidal stages; nature of reef surface; effect of reef on surf and tide conditions; presence of boat channels, including location, depth, width, and capability of improvement; distance offshore of barrier reefs; and depth, nature of bottom, and landward slope of lagoons.

2. Sandbars. Distance offshore, width, length, consistency, slope (both seaward and landward), depth below water at various tidal stages, passages for landing craft, and inshore water, including depth and nature of bottom.

3. Rocks and shoals. Location, extent, size, and height above or depth below water at various tidal stages.

4. Seaweed. Location, extent, and type (kelp, dulse, rockweed, sea lettuce, etc).

(*c*) *Beach description.*

1. Geographical location. Geographical coordinates of the beach limits and the bearings and distances from the beach to major topographical manmade features in the general vicinity.

2. Extent. Width and length of the beach at mean low and high water; location and extent of runnels, groins, and rock outcroppings which reduce the length or width of the beach.

3. Composition and consistency. Composition and consistency of the beach including its texture (fine or coarse); type of material (sand, gravel, mud, etc); practicability of traversing by troops and vehicles, both tracked and wheeled; effect of the tide on the surface (whether beach becomes hard and packed at low water); and the degree of solidity offered by any vegetation growing on the beach.

4. Gradient. The low-water to high-water gradient and the high-water-zone gradient.

5. Natural obstacles. Location, type, and extent of all natural obstacles—such as marshes, swamps, cliffs, dense brush, water areas, berm line, dune line, escarpments, etc.

6. Routes of egress. Location, size, condition, and capability of improvement of all beach exits.

7. Dispersal and storage areas. Location, size, and description of areas of the beach that can be used for dispersal and storage of equipment and supplies.

8. Inland limit. Configuration and nature of the ground at the inland limit of the beach.

(*d*) *Inland and adjacent terrain.*

1. Critical terrain features. Commanding terrain, inland or to the flanks of the beach, which could canalize transportation.

2. Landmarks visible from seaward. Bearings and distances to landmarks visible from sea which might serve to identify the landing area.

3. Natural obstacles.

(a) Location, type, and extent of marshes, swamps, and other water areas.

(b) Width of streams, their depth, velocity, nature of bottom, types of banks, and location of any existing fords.

(c) Type, location, and traversability of dense vegetation.

(*e*) *Facilities, resources, and defenses.*

1. Communications.

(a) Location, width, condition, and surface of roads and trails, in the vicinity of the beach.

(b) Dimensions, type of construction, and condition of bridges and underpasses; depth, width, and approaches of nearby fords.

(c) Gage, extent, and condition of railroad tracks.

(d) Number and type of wires on telephone and telegraph lines.

2. Warehouses. Location, size, and contents of warehouses and supply dumps close to the beach.

3. Obstacles. Location, type, and number of artificial obstacles in water and on the beach—such as mines, booms, barriers, nets, wires, tank traps, seawalls.

4. Restricted areas. Location, extent, and type of chemically, radiologically, or biologically contaminated areas.

5. Small craft. Location, type, and approximate number of naval craft, such as torpedo boats, which are capable of resisting a landing.

(7) *Wharves.*

(*a*) *Type.* Fixed or floating.

(*b*) *Purpose.* General or special cargo, or passenger.

(*c*) *Structural features.* Materials, deck area, strength of deck, height above high water,

superimposed structures, location and width of aprons.

(*d*) *Cargo-handling machinery.* Types and capacity.

(*e*) *Railroads.* Those on and leading to the facility.

(*f*) *Berths.* Number of and classification.

(*g*) *Lighterage facilities.* Type, number, and characteristics of craft.

(8) *Mooring berths.*

(*a*) *Fixed.* Location, layout, number, type, size, capacity. Types of mooring berths should include all POL tanker loading and discharge buoys.

(*b*) *Free-swinging.* Location, number, layout, capacity according to the standard classification listed below (minimum dimensions are given).

1. Class I. Eight hundred-yard diameter, 38-foot depth. Can accommodate large passenger ship or large naval vessel.

2. Class II. Five hundred-yard diameter, 30-foot depth. Can accommodate standard oceangoing cargo ship (Liberty or Victory).

3. Class III. Three hundred-yard diameter, 20-foot depth. Can accommodate small ships (standard coaster, destroyer, etc).

(9) *Port, beach, and landing area clearance facilities.* Characteristics, connections, and capacities of rail, road, air, waterway, and pipeline facilities. Information should include:

(*a*) *Rail.* Lines clearing port (for each line-number of tracks, gage, connecting points, distances), rail facilities in port (connecting line to port area from main terminal point), trackage in port area, railroad yards, bridges and ferries forming integral part of port rail network.

(*b*) *Road.* Roads and highways clearing port: major routes clearing port, connecting points, types of construction, width, condition; streets and roadways in town and port area and adequacy for port operation requirements.

(*c*) *Inland waterway.* Type, connecting points, controlling dimensions, number and type of craft in service for each route clearing port.

(*d*) *Air.* Airfields and airfield facilities in vicinity of port, beach, or landing area; connecting roads; open spaces suitable for improvised landing areas.

(*e*) *Pipelines.* Number, location, commodity carried, size, length, capacity, connecting points, pumping stations, repair facilities, planned construction, type of pipe, permissible pressures. (This information is obtained by coordination with the Quartermaster Corps.)

(*f*) *Miscellaneous.* Data concerning pack and draft animals, human bearers, cableways, and sled trains.

(10) *Mechanical handling facilities.* Number by type, location, and capacity including cranes, stevedore gear, and special purpose equipment. Include special handling equipment for liquid fuel, explosives, perishables, and containers.

(11) *Storage facilities.* Details of storage facilities, including location and capacity of transit sheds, warehouses, cold storage, petroleum storage, bulk storage (grain, coal, ore), open storage, and van container and chassis storage.

(*a*) *Covered storage.*

1. Warehouses and transit sheds. Total space available in port and description of each unit. Location, owner and/or operator, commodities stored, dimensions, type of construction, total capacity, rail and road connections, fire protection system, and materials handling equipment.

2. Cold storage facilities. Location, owner and/or operator, commodities stored, type of construction, type of equipment, daily ice capacity, and storage capacity of each facility.

3. Bulk storage facilities.

(a) *Liquid.* Total capacity, breakdown by product, general location and arrangement of storage facilities, owner and/or operator of individual facilities.

(b) *Dry.* Total capacity and general location and arrangement of each storage facility for grain, coal, and miscellaneous dry products.

(*b*) *Open storage.* Availability of sites in waterfront area for storage of general cargo, rail or road access to these sites, and location and size of individual sites.

(12) *Repair facilities.* Characteristics and capabilities of drydocking and ship repair facilities, including repair shops, drydocks (floating and graving), marine railways, fitting-out and repair berths, and miscellaneous repair yards and facilities. Information should include the sizes of the largest vessel that can be repaired and the largest dry-cargo ship that can be built. The information on individual shipyards should include—

(*a*) *Facilities.*

1. Shipbuilding installations: ways, docks, site.

2. Drydocking installation, including marine railways.

3. Fitting-out and repair berths.

4. Shops: scope of activity, equipment, capability.

5. Cranes: number and types available capacities.

(*b*) *Operation and production.* Volume and type of construction and repair projects; capability; availability, source, and quality of materials used; procurement methods and policies; storage facilities.

(*c*) *Fire protection.* Brief description of equipment and facilities including types of fires that equipment is suited to combat (electrical, oil, wood, etc). This information is obtained in coordination with the Corps of Engineers.

(*d*) *Security.* Brief description of organization and installations; security regulations in force.

(*e*) *Personnel.*

1. Management: organization, competence, outstanding personalities.

2. Labor: number, categories, quality.

(13) *Utilities.* Availability, sources, adequacy, characteristics, and distribution. (This information may be obtained in coordination with the Corps of Engineers.)

(*a*) *Petroleum.* Number and capacity of bunkers, types of fuel and stocks maintained, methods of supply, and extent of facilities. If port has no petroleum barges and the capacity of the largest bunkering berth is less than the capacity of the largest alongside berth in port, give dimensions of largest bunkering berth.

(*b*) *Coal.* Availability of bunkers, quality of fuel and stocks maintained, methods of supply, rates of supply, and extent of facilities.

(*c*) *Water.* Supply of water for ships, methods of supply and extent of facilities, quality of water, type and adequacy of port supply. If port does not have water barges and the capacity of the largest watering berth is less than the capacity of the largest alongside berth, given dimensions of largest watering berth.

(*d*) *Electricity.* Characteristics of service current distributed in port area, adequacy of supply for port operations, source of current, and availability of outlets for controlled temperature containers and other electric-powered equipment.

(14) *Watercraft inventory and characteristics.* This information requirement includes the number and characteristics of vessels, boats, landing craft, amphibians, and other floating equipment, such as barges, tugs, and cranes. Significant characteristics (as applicable) are:

(*a*) Type.

(*b*) Destination.

(*c*) Length.

(*d*) Beam.

(*e*) Light displacement: deadweight and gross tonnage.

(*f*) Draft.

(*g*) Fuel: type, capacity, consumption.

(*h*) Speed: water, land.

(*i*) Operating range.

(*j*) Crew.

(*k*) Capacity: cargo, passenger, cubic foot (bale, grain, reefer), liquid cargo.

(*l*) Cargo-handling equipment.

(*m*) Number of hatches.

(*n*) Seaworthiness.

(15) *Port administration.*

(*a*) Organization and functions of local control agencies, scope of activities, extent of private ownership and control, outstanding personalities.

(*b*) Official services: quarantine, customs, immigration, police, free port, administration, location of facilities, extent of activities.

(*c*) Local port regulations.

(16) *Port trade and operations.*

(*a*) Number, size, type, and registry of vessels calling at port.

(*b*) Average number of passengers embarking or debarking monthly or annually.

(*c*) Average quantity of cargo, daily and monthly, handled at port; type of movement, discharge or loading; direction of movement, import, export, domestic. Average cargo-handling rates—hourly and daily, ratio of receipts to shipments, ratio of bulk cargo to general cargo, ratio of containerized cargo to general cargo, ratio of cargo worked alongside to cargo worked in stream, average vessel turnaround time, prevailing methods of cargo transfer over wharves from one area of port to another, actual or potential limiting factors.

(*d*) Size, efficiency, and organization of normal stevedore force; adequacy for normal port operations; availability of labor reserve; political orientation.

(17) *Protection.* Position, shape and alinement, dimensions, and construction of breakwaters and other protective works.

(18) *Silting and dredging.* Liability to silting and dreding requirements of all navigable fairways and herths.

(19) *Bridges and structures in harbors and ports.* Type and clearances (vertical and horizontal).

(20) *Naval installations.* Brief description including repair facilities.

(21) *Major repairs required.*

(22) *Safety features.*

(23) *Vulnerability to nuclear or CBR attack.*

E–3. Information Sources

a. Documents. The following types of documents are required for port and beach transportation planning and production of intelligence. Documents and data of the types listed below should be sent to the Defense Intelligence Agency and when requested, to intelligence officers at other headquarters.

(1) *Hydrographic charts.* There are several types of hydrographic charts—pilot, navigational, general sailing, coastal, and harbor. Charts of harbors show water depths, channels, islands, character of bottom, berthing facilities, and aids and hazards to navigation. Navigational charts show the topography of the shore and the salient features which aid navigation and berthing.

(2) *Port plans.* The port plans are accurate, large scale drawings, or representations, showing: the general overall layout with details on berthing, cargo handling, and storage facilities; beaches; feeder canals and tidal creeks; rail, road, and waterway connections and structures; and the location of important servicing installations and repair facilities.

(3) *Port publications.* Frequently descriptive brochures are issued by the port authority or the controlling body to publicize the port. Companies operating the various installations at a port also issue folders to attract business. Publications of this type, despite their limitations, may furnish valuable information about a port. In addition, publications of local chambers of commerce and boards of trade may give the advantages of a particular port.

(4) *Beach area surveys.* These are studies of areas that can be used for over-the-beach operations; they give characteristics of beach area, details of water, obstructions, hazards, and natural protections. These surveys also give the topography of land adjacent to the beach area, showing location and type of adjacent highway and rail facilities available for beach clearance; description of areas between beach and highway and railways, indicating hazards, natural obstacles, and amount and type of clearance required; and size, location, and description of areas that might be used in temporary storage and/or transfer of cargo.

(5) *Craft census.* This is an inventory of harbor craft and floating equipment including lighters, tugs, powered vessels, barges, and construction and maintenance craft, such as ice breakers, floating pile drivers, dredges, and draglines.

(6) *Traffic studies and statistics.* Statistical analyses of port activities are included in both national and local economic surveys, almanacs, and yearbooks. These anlayses furnish information on volume offloadings and loadings and provide a key to reception, discharge, storage, and clearance capabilities of the port as well as the number, type, draft, dimensions, and tonnage of vessels using the port during normal and peak traffic periods.

(7) *Guides to internal navigation.* Shipping registers, shippers' almanacs, national pilots, reports of inland waterway boards, and guides to internal navigation are types of documents published in several countries that give information on—

(*a*) Inland and coastal waterway routes and their characteristics, ports, locks, and limiting factors.

(*b*) Shipping of all types, including inland waterway, coastal waterway, and ocean shipping.

(*c*) General operating rules, regulations, and procedures.

(8) *Documentation of freight.* Samples of shipping documents, bills of lading, rules for marking containers, and related freight documentation material constituted information of intelligence value.

(9) *Design and construction standards.* Basic standards for design and construction of port and inland waterway facilities and equipment may be found in engineering texts, government publications, and equipment manufacturers' brochures. Such publications may contain information concerning national or regional standards for wharf or quay construction, vessel and cargo handling equipment characteristics, transit storage facilities, lock construction, and other marine facilities.

(10) *Construction plans and progress reports.* These include overall port and waterway improvement policy and programs; current and proposed port and waterway improvement plans

—projects planned, completed, or under way; and progress reports (dated) on all such projects.

(11) *Aerial (vertical and oblique) and ground photographs.* Photographs are essential, particularly closeup views of wharves and cargo handling facilities and equipment; road, rail, and waterway clearance facilities and equipment; locks, vessels, transit storage, and vessel repair facilities; floating equipment, vessels being worked alongside and in the stream; beaches and exits; and principal limiting structures.

(12) *Coast and geodetic survey publications.* Publications similar to the "U.S. Coast Pilot" are valuable sources of information.

(13) *Hydrographic office publications.* Publications comparable to "Sailing Directions," "Tide Tables," "Current Tables," and "Pilot Charts" contain valuable and transportation information.

b. Agencies.

(1) Port authorities.
(2) Weather and statistical bureaus.
(3) Chambers of commerce.
(4) Municipal.
(5) Ministry of transportation.
(6) Construction and engineering contractors.
(7) Commercial steamship lines.
(8) Military planning and operating sections and units.
(9) Stevedoring firms.
(10) Equipment and craft manufacturers.
(11) Governmental agencies comparable to U.S. Departments of Labor, Commerce, and Interior; Bureau of Internal Revenue: Hydrographic Office; and Martime Administration.

E–4. Estimating Water Terminal Throughout Capacity

a. General. Terminal throughput capacity is defined as the number of long tons of cargo that can be *received, discharged,* and *cleared* through a terminal in one 20-hour working day. The throughput capacity is determined by the three major factors explained below.

(1) *Terminal reception capacity:* the number and type of ships that can be moved into the harbor or coastal area of the terminal per day.

(2) *Terminal discharge capacity:* the number of long tons of cargo that can be discharged in the terminal per day.

(3) *Terminal clearance capacity:* the long tons of cargo that can be moved through and out of the terminal per day.

b. Basic Considerations. Data applicable to each terminal being evaluated vary according to each situation. In all cases, one of three capacities—*reception, discharge,* or *clearance*—is the limiting factor when determining a water terminal's throughput capacity. The checklist given at the conclusion of this paragraph will furnish guidance on collecting terminal data.

(1) *Berths and anchorages.* The first consideration is whether vessels can be brought into the anchorage areas and alongside the wharves, and in what numbers. Berths and anchorages are evaluated according to the size of vessels they can accommodate. See figure I–13 for anchorage and alongside berth classifications.

(2) *Wharf capacity.* Terminal reception and discharge capacities are based on the use of all available wharf facilities. In making the evaluation, all facilities suitable for handling general cargo should be included in the estimate—for example, open or covered terminals, naval wharves, ship-repair and fitting-out wharves. If the use of a particular wharf is doubtful and its capacity has been included in the estimate, a clarification should be given. Wharf capacity is determined by the factors discussed below.

(*a*) *Type.* The general term "wharf" includes both quays and piers. A quay is a wharf parallel to and built against the shoreline beside navigable water for loading and unloading ships. A pier is a wharf which projects into water. There are several kinds of piers, such as T-head, L-head, and marginal.

(*b*) *Layout.* The layout of the wharf must also be considered in estimating capacities. The analysis should include adequacy of approaches, stacking space on the landward side, raised or depressed tracks, curbs, fences, deck surfacing material, transit shed space, number and size of transit shed doors, and the depth of mean high and low water alongside.

(*c*) *Weather.* Weather, particularly during extreme conditions, has a direct bearing on the use of estimated capacity of a wharf.

(*d*) *Alinement.* The alinement of the face of a wharf is an important factor in determining the usable linear footage available. The angle points and curvatures along the wharf face must be considered and the linear footage reduced accordingly.

(*e*) *Deck.*

1. Load capacity. The load capacities of the wharf deck and of the transit shed floor are of

prime importance. A rule-of-thumb method for determining the adequacy of the load capacity is the present use of the wharf. If it is known that a certain cargo is normally handled, a fail load-capacity evaluation may be made.

2. Height. The height of the wharf deck must be considered in relation to the tidal rise.

(*f*) *Working space.* The working space is determined by the type of wharf, the length and width of the wharf apron, the wharf's decking, and its exits. The working space must be wide enough to allow general cargo to be unloaded and cleared without undue delay. Dimensions shown below can be used in planning. Local customs, specialized wharves, and unusual construction may permit variations in these figures.

1. Wharf length. For planning purposes, 100 feet of wharf is required for each hatch or each lighter to be discharged. The discharge rate for ships and coasters is reduced 20 to 25 percent for each 100-foot reduction in wharf length under the minimum required.

2. Wharf apron width. A wharf apron working area of at least 60 feet is necessary for proper cargo handling and shipside clearance when discharging from only one side of a wharf. When both sides of a wharf are used simultaneously, each side should have a 45-foot working space.

(*g*) *Depth alongside.* Fluctuations in tide levels affect the discharge of cargo, especially where tidal variation is great and ships need the advantage of high tides to reach their berths. If the wharves are not located in wet docks and if the tidal variations are extreme, the discharge—capacity estimate should be adjusted to reflect this condition. The effective terminal discharge capacity may be reduced as much as 50 percent if alongside depths are reduced below the operable minimum by the tidal range. Under normal conditions, the water should be at least 30 feet deep at low tide. (A minimum of 30 feet is used for planning purposes because this depth accommodates virtually all deep-draft dry-cargo vessels.)

(*h*) *Physical condition.* Physical condition must be considered when the usefulness of a wharf is evaluated, for deterioration or damage may limit its capacity.

(3) *Lighterage discharge.* Lighterage berths are assigned in units of 100 feet for each lighter. This unit measurement must be used realistically—any wharf length more than 100 feet but less than the next 100-foot unit is disregarded. For example, a 150-foot wharf accommodates only one lighter; a 275-foot wharf, two lighters; a 350-foot wharf, three lighters. All alongside berths with depths of less than 18 feet are considered lighter berths.

(4) *Local conditions.* Conditions may vary with localities and sometimes may be very unusual. When necessary, berth, wharf, and lighter discharge factors must be adjusted or reduced to meet emergencies imposed by local conditions.

c. Terminal Capacity Estimation Checklist.

Collect these data	*Compute these factors*	*To determine*
Channel depths Obstructions Enemy air activity Enemy surface activity Enemy submarine activity Climate and seasons Weather and tide characteristics Minefields or contaminated areas Capabilities in combating obstacles	(1) Evaluate to determine water terminal reception capacity.	
Tactical disperson requirements Wharf facilities Beach capabilities Discharge rates ashore Discharge rates in the stream Anchorage area Extent of destruction or contamination Climate and seasons Weather and tide characteristics Cargo-handling equipment available Floating craft and equipment available Transit sheds and areas Availability of local labor Space reserved for local economy Enemy activity	(2) Evaluate to determine water terminal discharge (input capacity.	Water terminal throughput capacity.
Capability of rail facilities Capacity of highway facilities Capacity of inland waterway facilities Capacity of pipeline facilities Capacity of air facilities Enemy activity	(3) Evaluate to determine water terminal clearance (output) capacity.	

E-5. Estimating Containership Berth Capacity

a. General. Water terminals and individual berths designed exclusively for containerships are increasing in numbers throughout the world. Because of the speed with which containerships can be discharged and turned around, containership berth capacity estimates should be computed separately from the water terminal throughput capacity estimation for general cargo vessels.

b. Basic Considerations. Since containerization is a relatively new concept, there is no tried and true method for determining capacities. However, experience gained from container terminals currently serving full containerships may be used for guidance in gathering intelligence. This experience indicates that a containership berth 640 feet long requires an average of 16 acres to accommodate a dry cargo container storage area, a refrigerated container yard, and facilities for packing, unpacking, and administration. If more precise details are desired on the amount of space required per berth and/or the number of containers that may be handled through the terminal, these factors must be examined:

(1) Frequency of containership arrivals.

(2) Capacities of containerships (use 20-foot container equivalents).

(3) Number and speed of cranes available per berth to unload the containerships.

(4) Availability of line-haul tractors, straddle cranes, and other port clearance equipment.

(5) Container storage method: on-chassis or stacked.

(6) Method of loading or unloading containers.

(7) Delivery radius and vehicle turnaround time.

(8) Receiving and holding capabilities of receiving installations.

c. Estimating Capacities. The three factors that affect the throughput capacity of a containership berth are ship discharge capacity, port clearance capacity, and holding area capacity. Any one of these three factors may be the limiting factor in determining the number of containers a containership berth can handle daily.

d. Hypothetical Problem.

(1) *Problem.* To determine how many containers a containership berth is capable of handling daily.

(2) *Facts bearing on the problem.*

(*a*) Two shoreside container cranes are available, each operable at a rate of 12 lifts per hour. (This is a conservative estimate as some cranes can handle a container every minute.)

(*b*) Cargo working hours per day are 20.

(*c*) Port clearance equipment includes: 4 straddle carriers for in-port movement and stacking containers, 60 tractors with trailers for port clearance.

(*d*) Delivery radius to receiving installations is 50 miles.

(*e*) Vehicle turnaround time is 4 hours.

(*f*) Available daily holding area capacity is 16 acres.

(*g*) Containership is a C5–S–79A design capable of carrying 870 20-foot containers.

(3) *Determining the limiting factor.*

(*a*) *Daily ship discharge capacity.* Using the two shore cranes at a rate of 12 lifts per hour, the ship discharge rate per day is 480 containers (12 lifts x 2 cranes x 20 hours).

(*b*) *Daily port clearance capacity.* The 60 trailers can be loaded in 2.5 hours (60 trailers ÷ 24 containers (12 lifts per hour x 2 cranes). With the turnaround time of 4 hours, the first vehicle is ready for a second load in 4 hours and the last vehicle in 6.5 hours (4 hours turnaround time + 2.5 hours to load 60 vehicles). The 60 vehicles can move 240 containers in four round trips (60 containers x 4 trips = 240 containers). Forty-eight of the 60 vehicles can carry an additional container out of the port during the 20-hour cargo working day. Therefore, the daily port clearance capacity is 288 containers (240 + 48).

(*c*) *Daily holding area capacity.* The daily holding area capacity is based upon the temporary storage area required and the space needed for covered storage and administrative functions.

1. Temporary storage area required. The temporary storage area required is determined by the number of containers discharged from the containership but not cleared from the terminal plus the number of containers that are brought into the terminal for retrograde shipment.

(a) There is an interim of 1.5 hours between the departure of the last vehicle and the return of the first vehicle four times during the 20-hour working day. Also there is a 2-hour period at the end of the work day during which containers must be moved to a temporary holding area. If discharge operations are to continue, the four straddle carriers must be used. Each straddle car-

rier can clear two containers to the holding area per lift. The four straddle carriers can move 168 containers from the ship to the intransit storage area during the 20-hour work day. (12 lifts x 2 cranes x (1.5 hours x 4 intervals) + (12 lifts x 2 hours) = 168.)

(b) Since the capacity of this containership (C5–S–79A design) is 870 20-foot containers, it is assumed that a holding area is required for 870 retrograde containers.

(c) The number of 20-foot containers requiring temporary storage is 1038 (168 + 870). Assuming the containers are placed unstacked on the ground, back to back, in single tiers with 4-foot aisles between each two containers, 249,120 square feet (1038 (20 x 12)) or approximately 5.7 acres are required for storage. In order to provide space for tractors to back in and for the straddle carriers to deliver and pick up containers, a corridor of at least 25 feet must be available on each side of the block of containers. This procedure will add 311,400 square feet (1038 (12 x 25)) or approximately 7.2 acres. Thus the total temporary holding area required is approximately 13 acres.

2. Space required for covered storage and administration. If other than containerized dry cargo is to be handled or if containers are loaded and unloaded in the port area, covered storage space is necessary. The American Association of Port Authorities requires 90,000 square feet (about 2 acres) of covered storage space per containership berth. Administrative space need not exceed 10,000 square feet (about one-fourth acre) per berth. As a conservative estimate, the space required for this containership berth is about 15.5 acres.

(4) *Conclusion.* The limiting factor in this containership berth is the daily ship discharge capacity. The number of containers which the berth is capable of handling daily is 480.

APPENDIX F

RAILWAY INFORMATION REQUIREMENTS

F–1. Areawide Information

a. Essential railway information requirements include—

(1) Relative importance of railway transportation in the national economy.

(2) Relationship of railways to industry and agriculture.

(3) Peacetime and wartime adequacy of railways.

(4) Military potentialities—major improvement or development needed.

b. A general description and analysis of the railway transportation system is also essential including—

(1) Relationship of railways to the other modes of transportation and the geographic distribution and density of railways and railway facilities.

(2) Small scale annotated maps, charts, and diagrams showing rail lines, gages, track numbers, route mileages, track (single, double, multiple) and electrified sections, operating divisions and mileages, important stations and junctions, branch lines, transfer points, critical bridges, limiting structures, and other facilities.

(3) Tabulations of railway mileages by systems (consisting of connected lines of one gage), lines, and operating divisions; by single, double, multiple, and electrified trackage of the same gage; by total track miles and total route miles; by lines planned and under construction; and by ownership (governmental or private).

(4) Details of electrification including general policy and trends, location of electrified sections, power source(s), current characteristics and operating voltages, distribution system, method of current distribution (third rail, etc), and alternate power sources.

(5) Discussion of common features of the railway network signaling and communications system and facilities, including—

(*a*) Nature and extent of communications and the railway sections in which radio, telegraph, or telephone communications exist.

(*b*) Methods of protecting train movements on running tracks, signal system and signaling devices, interlocking switches and signals, control points and connecting circuits, rules and operating procedures, and related data.

(6) Discussion of official construction standards and design specifications for railways, including roadbeds, bridges, tunnels, ferries, and other railway structures and facilities, and an analysis of the extent to which they are followed.

(7) Status and scheduling of current projects and proposed plans for the development or improvement of railways and railway transportation.

(8) Analysis of transportability factors: description and milepost location of controlling restrictions on each rail line, structure, clearance, equipment, and maximum loading diagrams (fig. F–1).

(9) General condition of the railway system, including an analysis of transportation capabilities, potentialities for military use, and principal limiting factors.

(10) Details of standarization, interchange, and multigage features or railroad equipment.

(11) Details of freight handling (loading, unloading, and transfer of loads) and handling equipment.

(12) Description of the organization, training, operations, and capabilities of railway transportation units in the country's military service, including copies of tables of organization and equipment, field and technical manuals, and related doctrine.

(13) Connections and interchange with adjacent rail systems, including international connections and equipment exchange and transfer facilities.

(14) Explanation of local terms and terminol-

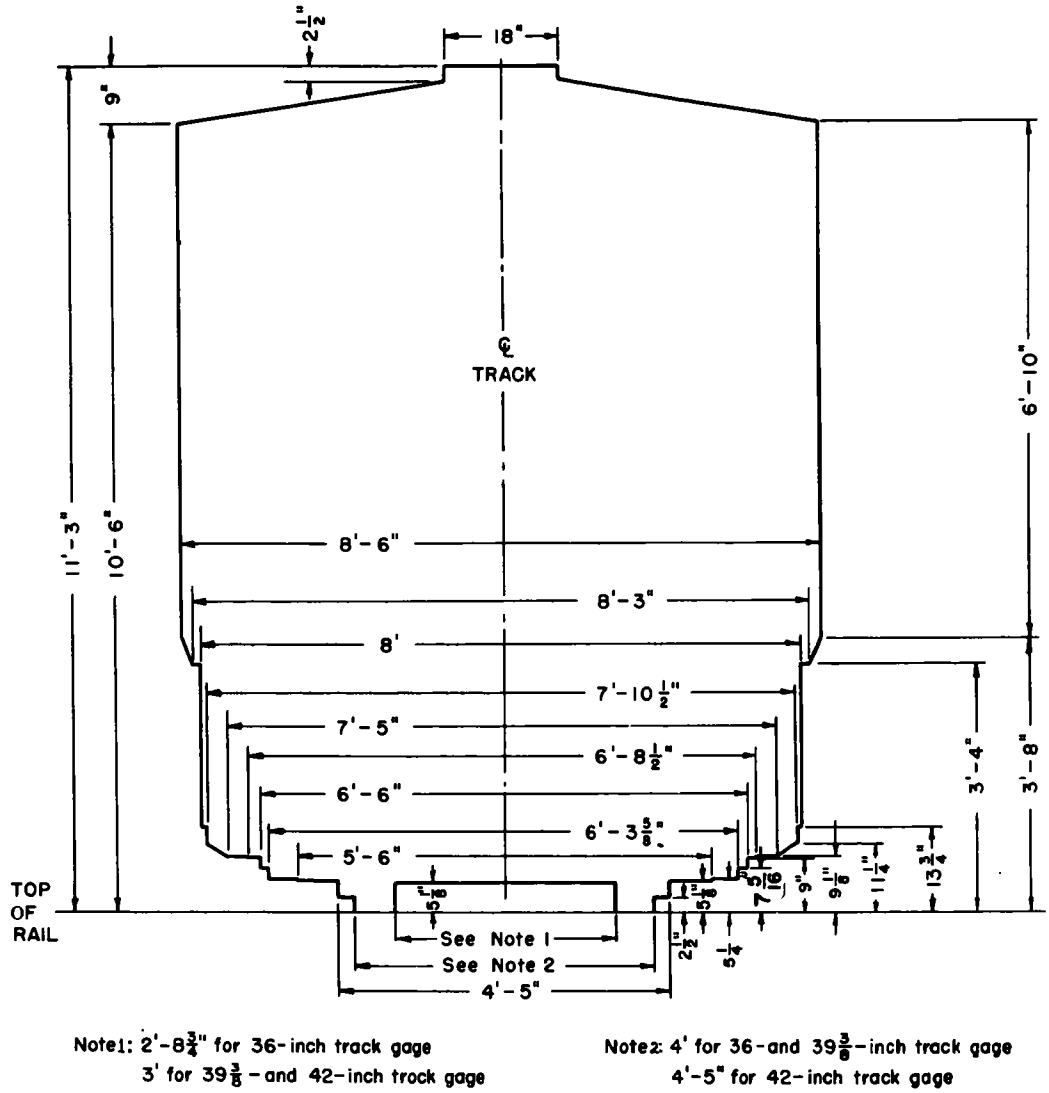


Figure F–1. A composite clearance diagram.

ogy used in describing railways and railway transportation activities.

c. Organization and administration of railways and railway transportation, including—

(1) Ownership (governmental or private); policy, extent, and effect of government control; and foreign interests and influences.

(2) Identity, location, and organization charts of agencies responsible for control and administration of railway transportation and a discussion of functions and programs.

(3) Number of railway personnel by departments and divisions, their training and education, and any political influence on appointment of key operating officials.

(4) Number of skilled and unskilled laborers, location of recruiting centers, training and experience, working conditions and wage scales, organization of train crews and maintenance crews, and dissident and sympathetic elements.

(5) Railway financial data, including operating and fiscal statistical railway records, rate tables, and rate fixing methods; government regulations affecting railway rates, operations, and accounting.

d. Status of railway construction, maintenance, and repair activities, including—

(1) Government policy, organization, funding, and procedures for initiation and execution of reconstruction; new construction; and maintenance and repair projects.

(2) General availability and quality of construction and maintenance equipment, materials, and labor—including sources of supply, efficiency of operations, construction skills, and statistics on equipment production.

(3) Railway construction and maintenance problems, procedures, and standards peculiar to the country and area.

e. Railway transportation research and development program, including—

(1) Research and development policy, trends, objectives, and capabilities.

(2) Testing and development centers, facilities, equipment, and key personnel.

(3) Current railway research and development projects and progress being made.

F–2. Detailed Description of Individual Railway Lines and Equipment

a. Line Identification and Description.

(1) Railway system: name and gage.

(2) Railway line number, length, terminals, ownership, and importance.

(3) Operating divisions or foreign equivalent: number, length, terminals, and motive power in service by types.

(4) Railroad line characteristics and facilities by operating divisions, including axleload limitations by line.

(5) Details and scheduling of new construction or improvements planned, underway, or completed (with dates).

(6) Data concerning structures and crossings (bridges, ferries, etc), including pevailing types and lengths, general condition, load capacity, total structures of each type, total length of bridges and tunnels, and similar statistics.

(7) Distances between all important junctions.

(8) Milepost location, description and photographs of all weight or clearance limiting structures, projections and obstructions (bridges, tunnels, station platforms, buildings, rock cuts, overhead structures, etc) that restrict the size and dimensions of rolling equipment and loads that can be moved over the railway lines (fig. F–1).

(9) Number of tracks and gage of each.

(10) Weight, type, and dimensions of rails.

(11) Ruling grades and curve radii (degree of curvature).

(12) Ties (type, number per mile, preservative treatment), whether or not tie plates are used, type of ballast.

(13) Sidings and passing tracks: locations, lengths.

(14) Drainage facilities, including culverts.

(15) Places on line that are potential nuclear targets.

(16) Operating, repair, and maintenance facilities, such as—

(*a*) Data on freight and passenger depots (waiting rooms, intransit storage).

(*b*) Icing facilities.

(*c*) Source and adequacy of power equipment and skilled labor.

(*d*) Administrative, servicing, and repair facilities, including offices; roundhouses; turntables; shops; mobile wrecking and repair equipment; stocks of repair parts, structural materials, and supplies; system and efficiency of shop operation.

(*e*) Signal, traffic control, and dispatching facilities.

(*f*) Roadway and track maintenance: materials and equipment used and methods and frequency of—

1. Renewal and maintenance of rails, including rail joints and accessories.

2. Crosstie and switch-tie renewal.

3. Ballast application and cleaning.

4. Switch, frog, and crossing maintenance and replacement.

5. Roadbed maintenance, including drainage and ditching.

6. Removal of weeds, snow and ice, and other impediments.

(17) Railway traffic and operations data about—

(*a*) Type and volume of cargo and passengers hauled annually, including data pertaining to freigh ton-miles hauled (net and gross), total tonnage by commodity, average time and distance of freight haul, freight car loadings, average turnaround time, and passenger-miles traveled.

(*b*) General conditions and capabilities of the railway line and operating divisions—including average number and kind of trains moving in each direction per 24 hours, the number of cars and net train load, train length and running time, average and maximum train speeds and weights, and net daily line-tonnage.

(*c*) Description and analysis of serious

traffic interruptions and control measures with data showing incidence by cause, season, and area of occurrence.

(*d*) Location and description of principal limiting features, such as ruling grades, curves, clearances, capacities, and speeds.

(*e*) Type of train control on each line: automatic block, manual block, centralized traffic control, train orders, timetable, etc.

(*f*) Operating rules, regulations, methods, and procedures.

b. Bridges.

(1) *Location and identification.*

(*a*) Line number, section, and operating division.

(*b*) Structure name, number, or other identification.

(*c*) Coordinates and mile or kilometer station.

(*d*) Stream, road, or body of water crossed.

(*e*) Map and photographic references.

(2) *Characteristics.*

(*a*) Type of bridge including material, construction, and whether fixed or movable.

(*b*) Length between abutments and overall length, including approach spans.

(*c*) Number, type, and length of spans.

(*d*) Size and type of abutments and piers.

(*e*) Alinement, gradient, and curvature of approaches.

(*f*) Traffic data: number of tracks, axleload limits, permissible speeds, distance between track centers if double track, vertical and horizontal clearances, date built ot rehabilitated, and present condition (dated).

(*g*) Alternate routes and distances.

(*h*) Basic documents, including clearance diagram, bridge book, photographs, and construction plan.

c. Tunnels.

(1) *Location and identification* (same as in *b*(*1*) *above*).

(2) *Characteristics.*

(*a*) Length, number of tracks, and distance between track centers if double track.

(*b*) Vertical and horizontal clearances, minimum radius of curvature, and maximum gradient.

(*c*) Present condition, details of drainage and ventilation, and standard of maintenance.

(*d*) Any unusual features or facilities.

(*e*) Alternate routes and distances.

(*f*) Clearances, diagrams, photographs, and construction plans.

d. Train Ferries.

(1) *Location and identification* (*same as b*(*1*) *above*).

(2) *Ferry route details.*

(*a*) Names of terminals and water distances between them.

(*b*) Periods usable.

(*c*) Possible alternate routes or crossing points.

(3) *Ferry inventory and characteristics.*

(*a*) Name, age, condition, railway car and locomotive capacity, and maximum permissible loading in gross and net tons for each ferry.

(*b*) Description of ferries: length, beam, and draft; type motive power and horsepower; fuel type and capacity; speed; method of unloading (side to end); number; length, and arrangement of tracks; details of the aprons; size and weight of largest item handled; number and type of operating personnel; special features of ferry design or operation.

(*c*) Traffic statistics:

1. Nature, volume, and density of ferry traffic.

2. Crossing time (light and loaded) and roundtrip time, including time for loading, mooring, and unloading.

3. Traffic interruption factors and incidence.

(*d*) Terminal facilities:

1. Name, location, and importance.

2. Details of docking facilities, operating personnel and equipment, and operating capability and limitations.

3. Potentialities for military use.

e. Yards and Terminals.

(1) Name, location, and importance.

(2) Number, length, and car capacity of tracks at each location by type—including receiving, classification, outbound and storage, and other tracks (rip, scale, icing, pen, shop, engine, diesel, coach, team, industry, roundhouse, turntable, and wye).

(3) Switching method and rate (flat and hump), hump location and gradient (manual or mechanical hump), type and location of retarder

(braking device), normal working hours, and number of switch engines worked.

(4) Classification—yard capacity in cars handled per day.

(5) Operating rules, methods, procedures, and limiting factors.

(6) Details of signaling and communication system employed.

(7) Location, type characteristics, and capacity of storage, warehousing, service and repair facilities.

f. Fuel and Water Stations.

(1) Location, type (passenger or freight), and capacity.

(2) Source, method, and adequacy of water and fuel supply.

(3) Water treatment required (at specific locations) before use in locomotives.

g. Stations.

(1) Location, type (passenger or freight), and capacity.

(2) Type platforms, height and clearance.

(3) Type and number of tracks.

(4) Storage, warehouse, and heavy lift facilities.

h. Passing Tracks on Single-Track Lines.

(1) Capacity at each location.

(2) Distances between passing track locations.

(3) Minimum length of passing tracks and location.

i. Electrified Sections.

j. Signaling and Communications Facilities.

k. Miscellaneous Facilities.

(1) Sanding facilities: location, capacities, and types.

(2) Nature, location, and capacity of wye tracks and other turning facilities.

(3) Snowsheds, retaining walls, etc. Description should include location, dimensions, clearances, type material, and construction.

(4) Special equipment and operating personnel, including location, characteristics, and inventory of work cranes, snowplows, rail detectors, hospital trains, track-laying equipment, etc.

l. Equipment Characteristics and Inventory (Fig. F–2, F–3, and F–4). Information collected should include facts about—

(1) *Characteristics.*

(*a*) *Locomotives.* Type of locomotive, gage, tractive effort (starting and continuous), wheel arrangement and size, overall length, fuel, horsepower, manufacturer, markings and nameplate data, year built or put into service, type of fuel required, and any other pertinent data, such as water treatment.

(*b*) *Cars.* Type (passenger and freight), type of coupler and height above rail, side or center buffers (if side buffers, give horizontal bracing), type of brakes, gage, number of axles, type of journals, overall dimensions, capacity, manufacturer, markings, and year built or put into service. For freight cars, also give type (box, flat, gondola, tank, etc), load limit (volume and weight), tare weight, commodity for which car is designed and openings (number, size, and types of doors, vents, etc).

(*c*) *Special equipment.*

1. Self-propelled rail cars. Total number, weight, dimensions, capacity, horsepower, manufacturer, markings data, year built or put into service.

2. Wreckers (crane). Type (steam, diesel, diesel-electric), lifting capacity, weight, length of boom, wheel arrangement.

3. Hospital train. Litter capacity, kitchen facilities, type of power car.

4. Snowplows. Rotary blade, V-blade, V-blade and spreader, V-blade with ice-cutting attachment.

5. Weed control. Weed burner (fuel), wood sprayer (chemical).

6. Special purpose freight cars. Cars for carrying oversize, cumbersome, odorous, explosive, corrosive, or contaminated cargo.

7. Miscellaneous. Train ferries, car floats, track-laying equipment, inspection and maintenance cars, rail detectors, clearance feelers, switches, wheel grinders, couplers, and buffers.

(2) *Manufacture and procurement.*

(*a*) Principal domestic manufacturers: location, production statistics, and capacity.

(*b*) Foreign sources, if any, and agencies responsible for procurement.

(3) *Maintenance.* Responsible agencies, policies and procedures, standards, adequacy of facilities, availability of materials and trained personnel.

(4) *Statistics.* Number and type of locomotives, rolling stock, and special equipment in operation, awaiting repair, and out of service at any one time.

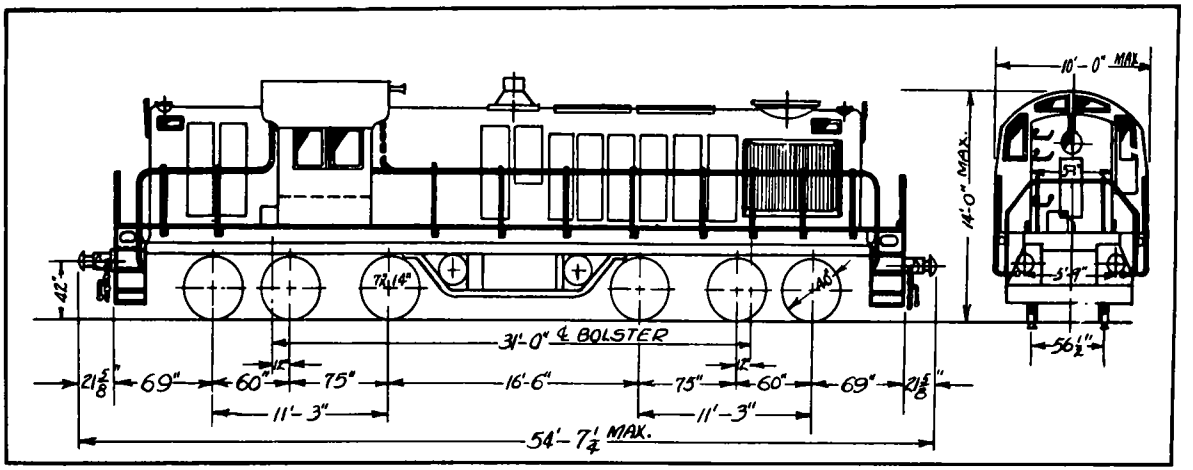


Figure F-2. Sample report: diesel-electric locomotive, 0-6-6-0 type.

Weights
- On driver, 252,000 lb (1/2 tank)
- Total locomotive, 252,000 lb (1/2 tank)

Maximum axle limitation, 22 short tons
Horsepower, 1,000 bhp
Maximum speed restriction, 60 mph
Engine
- Type, 6-cylinder, supercharged, 4-cycle
- Cylinders, 6
- Cylinder, bore and stroke—12 1/2" x 13"
- Displacement, 9,550 cu in.

Electrical
- Generator, 1,350 amperes
- Exciter, 65 amperes
- Motors, 740 amperes
- Control equipment, type "P," 1 on right side
- Radiator fan, large diameter, engine-driven
- Batteries, 32-cell, 64-volt
- Lighting circuit, 60-volt
- Headlight, 250-watt

Capacity
- Fuel, 1,600 gal.
- Cooling water, 240 gal.
- Lubricating oil, 80 gal.
- Sand, 27 cu ft

Tractive effort
- Starting, 63,500 lb
- 5 mph, 40,000 lb

Airbrake
- Schedule, Westinghouse, EL-14 type
- Brake cylinders, 8" x 10" x 10", type "B"
- Pumps, 83 cu ft per minute
- Pump capacity at full engine speed, 228 cu ft per minute
- Reservoir capacity, 69,800 cu in.
- Handbrake, connected to one truck

Trucks
- Type, two 6-wheel swivel,equal, rigid bolster, pedestal

Wheels, 6 pair, 40", rolled steel
- Brake cylinders, eight 10" x 10", type "B"

Limiting dimensions
- Maximum radius of curvature (locomotive alone), 25°
- Gage, 4' 8 1/2"

Sanders, 8 sander traps
Traction motor blower, B.F. Sturtevant Company
Draft gear, spring type
Coupler, screw link and hook type

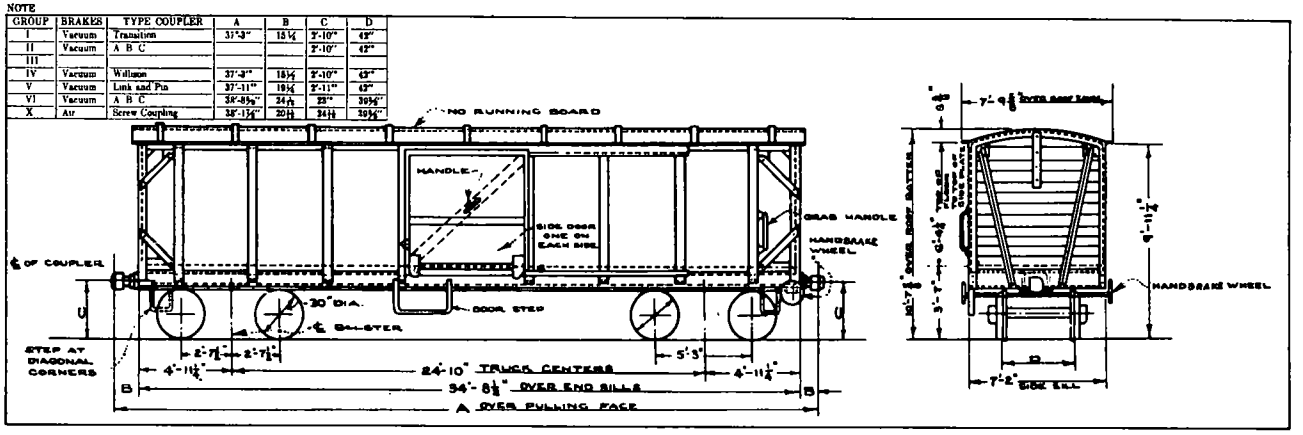


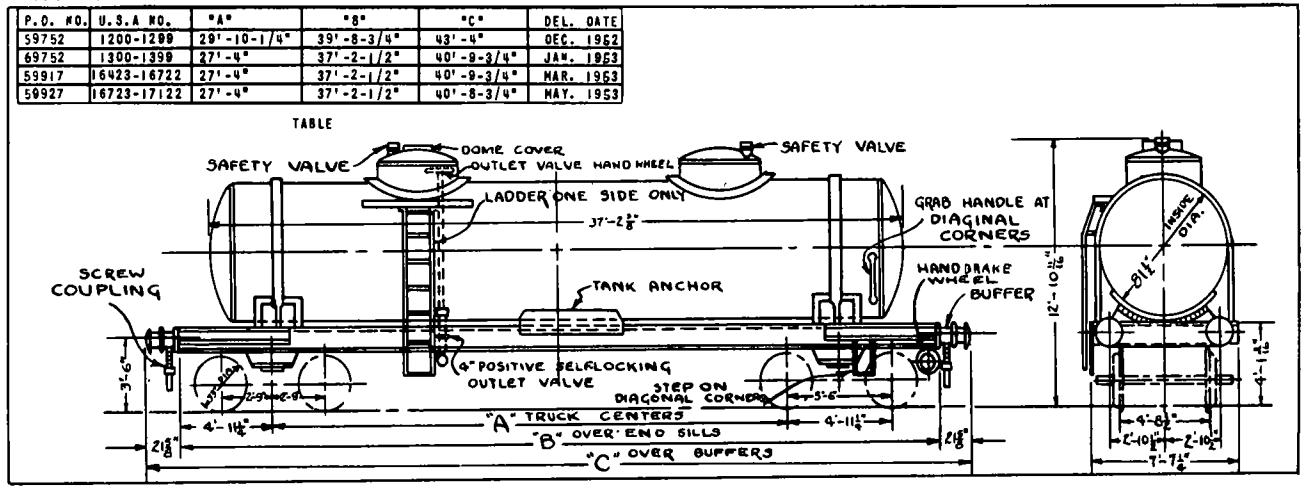
Figure F–8. Sample report: 80-ton boxcar.

Gage, 39 3/8"
Load limit, 30 tons
Capacity, 1,490 cu ft, 30 tons
Light weight, 31,600 lb
Inside dimensions
  Length, 34' 6"
  Width, 7' 1"
  Height, 6' 1 3/16"
Outside dimensions
  Overall length over sills, 34' 8 1/2"
  Overall length over couplers (see note)
  Width at end sills, 7' 2"
  Extreme width, 7' 10 3/4"
Door dimensions
  Width, 8'
  Height, 9' 10"
Overall height from rail
  To extreme width, 9' 11 1/4"
  To roof, 10' 6 1/2"
  Extreme height, 10' 7 5/8"
Number of axles, 4
Wheels, 525 lb, 30", cast iron
Size of journals, 4 1/4 " x 8"
Type of brakes--vacuum, hand, and air
Type of couplers (see note)
Number of doors, 2
Underframe, built-up steel
Center sill, two 12 3/16" back-to-back channels, each at 31.3 lb per linear ft
Side sill, 9" channel at 13.4 lb per linear ft
End sill, 12" channel at 25 lb per linear ft
Bolster, 3/16", steel pressing
X-bearer, 3/16", steel pressing
Cross tie, 3/16", steel pressing
Side posts, 3/16" pressed channel
Side sheathing, 1/2" plywood, 48" panels
End posts, 3" channels at 5.1 lb per linear ft
End sheathing, 1 1/4", tongued and grooved
Roof, 3/8" plywood, 48 panels
Truck side frame, cast steel (integral journal box)
Side bearing, friction type

NOTE:

P.O. NO.	U.S.A NO.	"A"	"B"	"C"	DEL. DATE
59752	1200-1299	29'-10-1/4"	39'-8-3/4"	43'-4"	DEC. 1962
69752	1300-1399	27'-4"	37'-2-1/2"	40'-9-3/4"	JAN. 1963
59917	16423-16722	27'-4"	37'-2-1/2"	40'-9-3/4"	MAR. 1963
59927	16723-17122	27'-4"	37'-2-1/2"	40'-8-3/4"	MAY. 1963

TABLE



Gage, 4'8 1/2"
Load limit, 40 tons
Capacity, 1,290 cu ft, 9,900 gal.
Light weight, 40,000 lb
Inside dimensions
- Length of tank, 37'2 3/8"
- Diameter of tank, 6'9 1/2"
- Diameter of dome, 4'0"

Outside dimensions
- Overall length over sills (see note)
- Overall length over buffers (see note)
- Width at end sills, 7'7 3/4"
- Extreme width, 8'2"

Overall height from rail
- To extreme width, 1'6"
- To top of tank, 11'9 1/16"
- Extreme height, 12'10 11/16"

Number of axles, 4
Wheels, 650 lb, 33" diameter, cast iron
Size of journals, 5" x 9", AAR
Type of brakes, air (with vacuum line)
Type of couplers, screw coupling

Safety valves, tested at 24 lb
Tank, tested at 60 lb
Number of domes, 2
Underframe, built-up steel
Center sill, two 12 13/16" back-to-back channels, each at 31.3 lb per linear ft
Side sill, 10" channel at 15.3 lb per linear ft (from end sill to bolster)
End sill, 5/16" formed plate
Bolster, 1/4" steel pressing
Cross bearer, none
Cross tie, none
Tank shell
- Top and side sheets, 1/4" steel
- Bottom sheet, 3/8" steel

Tank head, 3/8" steel
Tank dome, 1/4" steel, 48" diameter
Safety valve, 5" with resilient gasket
Outlet valve, 4" self-locking type
Dome cover, on one dome only
Truck side frame, cast steel (with integral journal boxes)
Side bearing, friction type

Figure F-4. Sample report: 9,900-gallon tank car.

F–3. Information Sources

a. Documents. Maps, photographs, and basic documents of each railway system are required that show—

(1) Line profiles; track charts; structures, loading, and equipment clearance diagrams.

(2) Tunnel, bridge, and equipment registers.

(3) Signaling, standard plan, rule, and station diagram books.

(4) Current railroad maps and aerial and ground photographs.

(5) Passenger and operating (trainmen's) timetables.

(6) Railway engineering texts, technical and scientific treatises, and brochures.

(7) Train sheets, railway operations data, and traffic flow charts.

(8) Reports: route, reconnaissance, construction plans and progress, and annual reports.

(9) International railway agreements.

(10) Organizational charts; facility plans and layouts.

(11) Railway equipment manufacturers' brochures, catalogs, service and maintenance manuals, operating instructions, specifications and drawings, pilot models, and prototypes.

(12) Statistical publications, tariff regulations, and rate schedules.

b. Agencies.

(1) Officials in control—governmental or private. These officials are responsible for policy and procedure, administration, finances, personnel, public relations, operating rules and regulations, traffic operations, construction and maintenance, rolling stock, and research and development.

(2) Divisional and regional officials responsible for implementing the functions described in *a* above.

(3) Train crew (engineers, conductors, brakemen), station and yardmasters, construction and maintenance units and personnel.

(4) Manufacturers of locomotives, rolling stock, and equipment.

(5) Major shippers and shippers' associations.

F–4 Estimating Railway Capacity

a. General. Even though the amount and quality of technical information available for analysis varies, a standardized method of approach insures use of the same principles of evaluation. The evaluation methods discussed in this paragraph are applicable primarily to the problem of determining the enemy's logistical capability by rail. In general rail capability depends upon net division tonnage, terminal facilities, and service and repair facilities. The intelligence data needed to estimate a railway's capacity can be produced by following the procedures described below. Additional guidance for determining railway capacity may be found in FM 55–20.

b. Net Division Tonnage. Net division tonnage is the tonnage (short tons), or payload, that can be moved over a railway division each day. To calculate net division tonnage, basic assumptions must be made and essential factors considered.

(1) *Basic assumptions.* A study of a capacity problem must be accompanied by a statement of the assumptions upon which the suggested solution is based. The assumptions listed below may be considered basic ones in the solving of rail capacity problems; however, conditions may necessitate the making of other assumptions. Generally, it may be assumed that:

(*a*) An adequate number of freight cars and locomotives will be available.

(*b*) An adequate number of qualified personnel will be available.

(*c*) All trains will be freight trains or will be operated at freight-train speed.

(*d*) Enemy action will not interrupt operations.

(*e*) Operations will continue more than 72 hours.

(2) *Essential factors.*

(*a*) *General.* Net trainload and train density are essential factors in determining net division tonnage. The net trainload is the net tonnage that can be carried by each train. Train density is the number of trains that can be operated each way over a line in a 24-hour period.

(*b*) *Net trainload.*

1. General. Net trainload is the payload carried by the train. The total weight of the cars under load is the gross weight; the weight of the cars empty is tare or light weight. The difference between these two is the net load (payload) of a train. (Generally the payload is 55 percent of the gross trailing load.) Tractive effect (TE) and gross training load (GTL) are important factors that must be considered in calculating the net trainload. The length of passing sidings on a line

and the effect of weather are also factors which must be considered.

2. Tractive effort. Tractive effort is the horizontal force which a locomotive can exert provided its wheels do not slip. The tractive effort figure used should be that of the type of freight locomotives used on the railway being studied. If the tractive effort of a locomotive is not furnished by some reliable source, such as the manufacturer, it can be computed by using known locomotive characteristics or by rule-of-thumb method (FM 55–20). Tractive effort is classed as starting and continuous. The former is the effort required to start the locomotive; the latter is the effort required to keep the locomotive moving. Generally, starting tractive effort is equal to or greater than the continuous tractive effort. The starting tractive effort on the level should be compared with the continuous tractive effort required to keep the same train moving on the ruling grade of a line. The larger tractive effort required will control the size of the train. Therefore, the analyst must bear in mind the ruling grade of the line under study. However, because of the many variables involved, the following discussion of tractive effort does not include the effect of the ruling grade of a line; only level track is considered. Consequently, in this discussion the starting tractive effort is considered the controlling factor in determining the pulling power of a locomotive. Steps in computing tractive effort, using known locomotive characteristics, are described below according to type of locomotive.

(a) *Steam locomotive.* The effective energy at the wheel rim is reduced because of friction of the piston, piston rod, crosshead, and the various bearings. The steam pressure in the cylinder is always less than that in the boiler, even at low speed and full cutoff. These reductions may be allowed for by figuring the steam pressure (effective at the drivers) to be 85 percent of the boiler pressure. The rated, or starting, tractive effort may be determined by using the formula given below. It may be used with no appreciable inaccuracy up to speeds of 15 miles per hour. One of the limiting factors of tractive effort is the frictional force, or adhesion, between drivers and rail. This is a function of the weight on drivers and of the coefficient of friction between the wheel and the rail. An average value of 0.25 is generally used for the latter; the corresponding reciprocal of the coefficient of friction is known as the factor of adhesion. The formula for determining starting tractive effort of a steam locomotive is:

$$TE = \frac{0.85 \times P \times d^2 \times S}{D}$$

where

TE = tractive effort in pounds
P = boiler pressure in pounds per square inch
d = diameter of cylinders in inches
S = length of piston stroke in inches
D = diameter of drivers in inches

A close approximation of the starting tractive effort may be obtained by using the simple formula of:

$$TE = 0.25 \times W$$

where

W = the weight of the locomotive on the drivers (adhesive weight)

The adhesive weight of a locomotive can be approximated by using the following information.

Wheel arrangement of locomotive	Percent of weight on drivers	Wheel arrangement of locomotive	Percent of weight on drivers
0–4–0	100	2–8–2	73
2–4–0	80	2–8–4	61
2–4–2	57	4–8–0	80
4–4–0	67	4–8–2	67
0–6–0	100	4–8–4	57
0–6–2	75	0–10–0	100
2–6–0	86	0–10–2	83
2–6–2	87	0–10–4	71
4–6–0	75	2–10–0	91
4–6–2	60	2–10–2	77
0–8–0	100	2–10–4	67
0–8–2	80	4–10–0	83
0–8–4	67	4–10–2	72
2–8–0	89	4–10–4	62

(b) *Diesel-electric locomotive.* Tractive effort curves are computed from data on generator-traction motors and auxiliaries with an overall limitation imposed by the horsepower rating of the diesel engine. These curves are furnished by locomotive manufacturers. Whenever possible, diesel-electric locomotive tractive effort should be obtained from these curves. If such curves are not available, starting tractive effort can be approximated by dividing the adhesive weight of the locomotive by 3. The continuous tractive effort can be approximated by dividing the adhesive weight by 6.

(c) *Electric locomotives.* The tractive effort for an electric locomotive is governed by the amount of power supplied to the motor and by the capability of the motor. Manufacturers of electric locomotives prepare tractive-effort curves that should be used when available. These curves are usually based on substation voltage. Because of

transmission losses, it is recommended that the values taken from these curves be reduced by 10 percent. Tractive effort may also be obtained by equating work done at the rim of the driving wheels to the work produced by the motor torque in one revolution of the driving wheels. The following formula gives hourly tractive effort: this can be considered the starting tractive effort.

$$TE = \frac{T \times 24 \times G \times E \times N}{D \times g}$$

where

TE = tractive effort in pounds

T × 24 = torque of a single motor. (Torque is taken at a 1-foot radius from the armature shaft center.)

G = number of teeth in the driving gear

E = combined electrical and mechanical efficiency (averages 80 to 85 percent)

N = number of motors

D = driving wheel diameter in inches

g = number of teeth in pinion gear

Continuous tractive effort for speeds between 5 and 10 miles per hour can be approximated by dividing the adhesive weight by 3.

3. Gross trailing load. This is the maximum weight a locomotive is capable of pulling. The gross trailing load is affected by locomotive tractive effort, train resistance, grade resistance, and weight of locomotive and tender. The gross trailing load (GTL) is calculated by using the following formula:

$$GTL = \frac{TE}{TR + GR} = W$$

where

GTL = gross trailing load in short tons

TE = locomotive effort in pounds

TF = train resistance. (This factor depends on the weight per car and the speed of the train. A resistance of 4 pounds per ton is considered an acceptable average when the speed of a train is from 5 to 15 miles per hour and the weight per car is 30 to 50 tons.)

GR = grade resistance. (This is found by multiplying 20 pounds per ton of train times the grade in percent.)

W = weight of locomotive and tender in short tons

4. Length of sidings. The net trainload is sometimes limited by the length of the passing sidings on the line. The minimum length of passing sidings should be compared with the length of train needed to carry the planned net tonnage. To do this, estimate the average freight car length and load per car.

5. Effects of weather. Snow, ice, and freezing temperatures affect train locomotives and operations, thereby reducing net tonnage. For winter operations, net tonnage should be reduced as shown below. (A reduction may not have to be made if the net trainload has already been reduced because of the siding lengths.)

Temperature		Percent of reduction in locomotive tonnage rating
Fahrenheit	Centigrade	
Above 30	Above —1	0
29 to 20	—2 to —7	10
19 to 10	—8 to —13	30
9 to 0	—14 to —18	20
—1 to —10	—19 to —23	35
—11 to —20	—24 to —29	40

(*c*) *Train density.* Train density varies greatly on different divisions—depending upon the type of line; number and location of passing tracks; train movement control facilities and procedures; and availability of train crews, motive power, and rolling stock.

1. Single-track line. The number of trains that can be operated in one direction on a single-track line in 24 hours depends on the speed of the trains, the maximum distance between passing sidings, and the delay time spent in a siding to allow other trains to pass. Additional time must be allowed for operating delays. The relationship of these various factors is shown by the following formula:

$$N = \frac{720 \times EF}{RT + DT}$$

where

N = train density in number of trains each way per day

RT = running time in minutes over longest distance between passing sidings on line. (Speed of train is usually considered as 15 mph—an average for war conditions. The speed might be 20 mph on an electrified line in good condition).

DT = delay time in minutes. (This is for meeting with trains from the opposite direction. It may vary from 0 to 15 minutes, depending on type of track and control: no delay occurs where there are long passing tracks and

centralized traffic control, whereas delays of as much as 15 minutes may occur on undeveloped lines.)

EF = efficiency factor. (This factor takes care of operating delays; it varies from 0.5 to 0.85 according to the type of signaling used. EF's for the various types of signaling are: telephone and ticket, and rudimentary, 0.5; 0.5; manual block, 0.6; automatic, 0.75; and centralized traffic control, 0.85.)

2. Double-track line. Estimates of maximum train density on double-track lines often vary greatly because these estimates, unlike those for single-track lines, are based largely on individual judgment. Assuming the use of an absolute blocking signal system on a double-track line, theoretically the type and interval of signals and the speed of the train are the only limiting factors. On a line that uses permissive blocking, train density is limited only by the braking distance between successive trains. Visibility and speed determine the braking distance. The possible train density of a double-track line is usually greater than the number of trains that can be assembled in the yards. The efficiency factor is the same for a double-track as for a single-track line (*1* above). The capacity of the yards and line may exceed the number of locomotives that can be serviced in existing facilities. Therefore it is necessary to calculate the capabilities of yard and terminal servicing facilities for each double-track line under consideration and to select the lowest capability as the limiting factor.

c. Terminal Facilities.

(1) *Classification yard.*

(*a*) The tonnage that can be classified and handled in a yard depends upon the total number of cars that can be held and operated in it. To estimate the tonnage capacity of a yard:

1. Determine the total trackage of the yard.

2. Multiply the total trackage figure by 0.60.

3. Convert this new trackage figure to numbers of cars by dividing it by the average length of the freight cars used on the line.

4. Determine the operational capability of the yard by multiplying its holding capacity in number of cars by its turnover factor. (The turnover factor, which means the number of times the holding capacity can be replaced daily, may vary from 2.0 for a hump yard with automatic facilities to as low as 0.8 for a flat yard with rudimentary operations.)

(*b*) This estimated yard capability should be checked against the line capability to make sure the yard will support the line operations.

(2) *Relay yard.* A relay yard is used to receive, service, and forward through trains; each train is kept intact. Car classification in these yards is not necessary. An appraisal must be made in each operation to determine which yards should be designated as relay yards. Operations in relay yards require an average time delay of 3 hours per train. This gives a train turnover factor of about 8 for a 24-hour period.

d. Service and Repair Facilities. The various distinctions made in classes of repair—not only worldwide but even on one railway—make it very difficult to estimate the maximum capabilities of railway servicing facilities. It is necessary, however, when studying the capabilities of a railway to estimate its service and repair facilities. This problem cannot be reduced to a formula; estimates of servicing capabilities must be based largely upon good judgment and experience. For example, a 2 to 4 turnover factor in 24 hours is usual for enginehouses: servicing a locomotive requires from 6 to 12 hours. Nevertheless, the capability to provide locomotives for line operations is not determined solely by the number of hours required to service a road engine because allowance must be made for the servicing of branch line and yard locomotive also. Care must be exercised not to overestimate servicing and repair facilities when estimating maximum train density.

APPENDIX G

MISCELLANEOUS TRANSPORTATION INFORMATION REQUIREMENTS

G–1. General

Transportation information should be collected in coordination with the technical service or agency responsible for operation of the modes discussed below.

G–2. Pipelines

The type of information listed below should be collected.

a. Name, terminal locations, fluid transported.

b. Route, length of line and of sections.

c. Number, diameter, type of construction (welded or coupled), and pressure capacity of pipes; delivery capacity of system under all conditions (gallons per day for liquid, cubic feet per day for gas); capacity of line when full. A guide for estimating pipeline liquid capacity is given below.

Diameter of pipe (in.)	Daily capacity				
	Gallons (bulk)	Short tons			
		83 octane gasoline		Lubricating oil	
		Bulk	5-gal. can	Bulk	5-gal. can
4	304,000	930	1,260	1,150	1,480
6	655,000	2,000	2,730	2,500	3,210
8	1,135,000	3,500	4,730	4,350	5,580

d. Facilities at receiving end—including storage facilities. When a pipeline terminates at a port, data on connections from ship to shore should also be included.

e. Storage facilities along the pipeline. This should include location, nature, and capacity of individual storage units and of total storage capacity at each location.

f. Critical points, such as swamps, defiles, and elevations along pipeline.

g. Pumping stations—including location, capacity, and equipment data.

h. Maintenance and repair facilities—including shops and data for any needed repairs or improvements.

G–3. Pack and Draft Animals

Pack and draft animals, including horses, mules, dogs, and other animals that may be used in this manner. Information concerning these animals should include—

a. Height and weight.

b. Rate of march and load-carrying capacity (personnel and/or equipment).

c. Food and water required per day.

d. Number available and noneffective rate.

e. Average daily distance for different terrain, gradeability.

f. Transportability of the animals.

G–4. Human Bearers

In some areas of the world, human bearers are used extensively. The transportation intelligence officer should be prepared to furnish information about—

a. Average cargo loads for male and female bearers; type of equipment used.

b. Bearers required for each litter team.

c. Degree of supervision required.

d. Number available, noneffective rate, and replacement capability.

e. Average rate of march for different conditions of terrain and weather.

G–5. Cableways or Tramways

Cableways or tramways are used in mountainous and beach areas. Information collected about these systems should include—

a. Location of the cableway or tramway.

b. Distance of operation over water and/or land.

c. Average daily tonnage capacity.

d. Maximum single lift of the system.

e. Equipment and personnel required to operate and maintain the system.

G–6. Sled Trains

Sled trains are used in arctic and subarctic areas. Information should include—

a. Characteristics of Prime Movers.

(1) Weight and dimensions.

(2) Carrying capacity: crew, passengers, and cargo.

(3) Fuel capacity, speed, and miles per gallon.

(4) Drawbar pull.

(5) Turning radius.

(6) Towed payload.

(7) Oil and grease consumption.

b. Characteristics of Sleds.

(1) Weight and dimensions.

(2) Load-carrying capacity.

(3) Details of construction (special-purpose sleds, etc).

APPENDIX H

SAMPLE INTELLIGENCE PHOTOGRAPHS

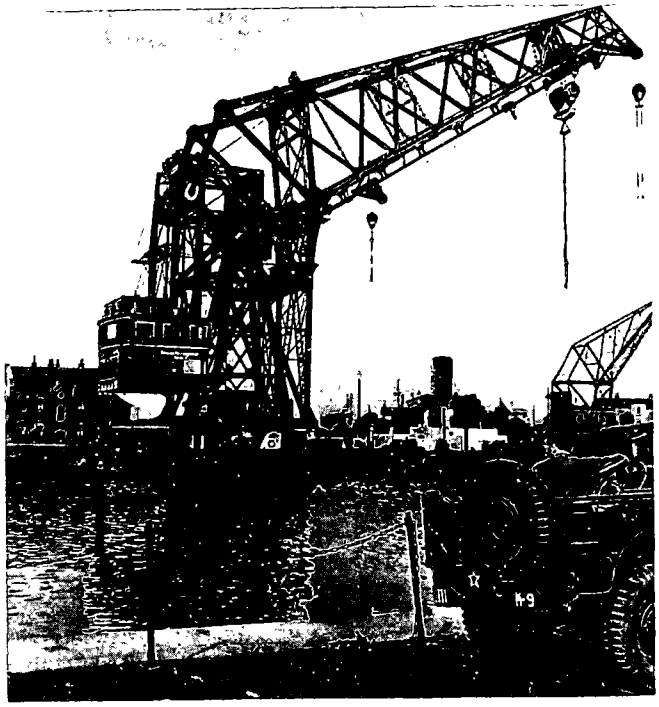


Figure H–1. A 250-ton floating crane.

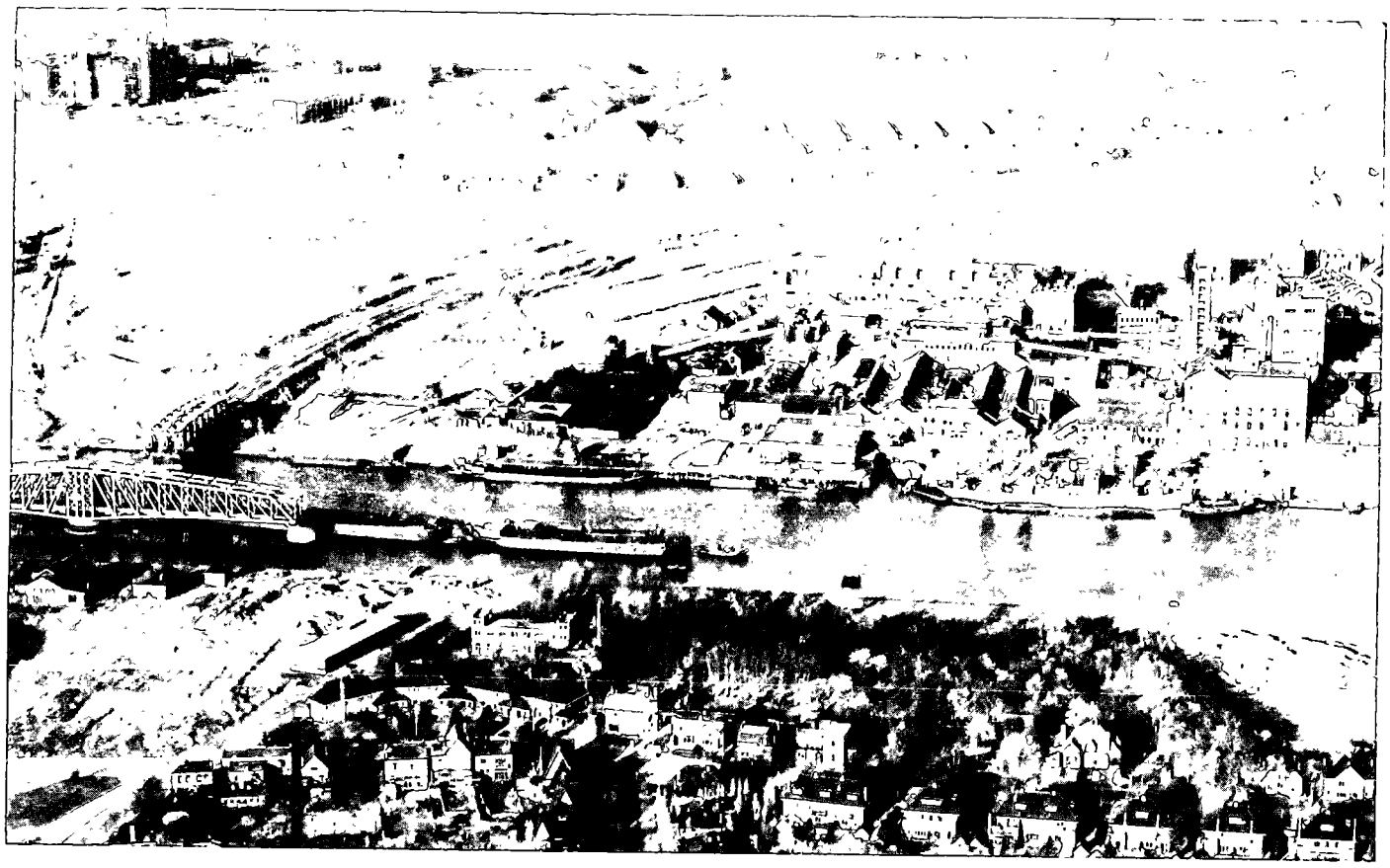


Figure H–2. Inland waterway terminal: swing span, rail yards, factories, and residential area.

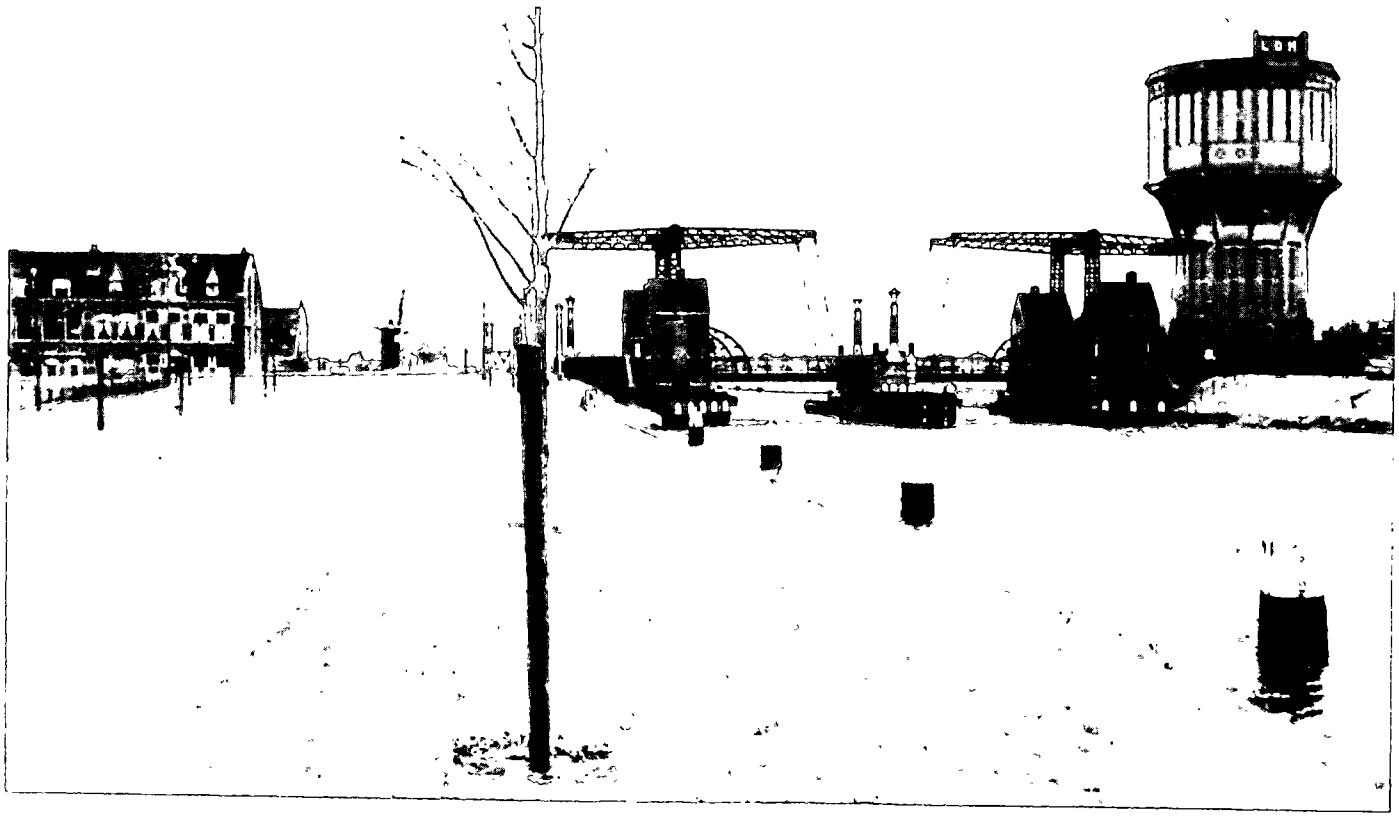


Figure H–3. Double-leaf bascule span with overhead counterbalances.

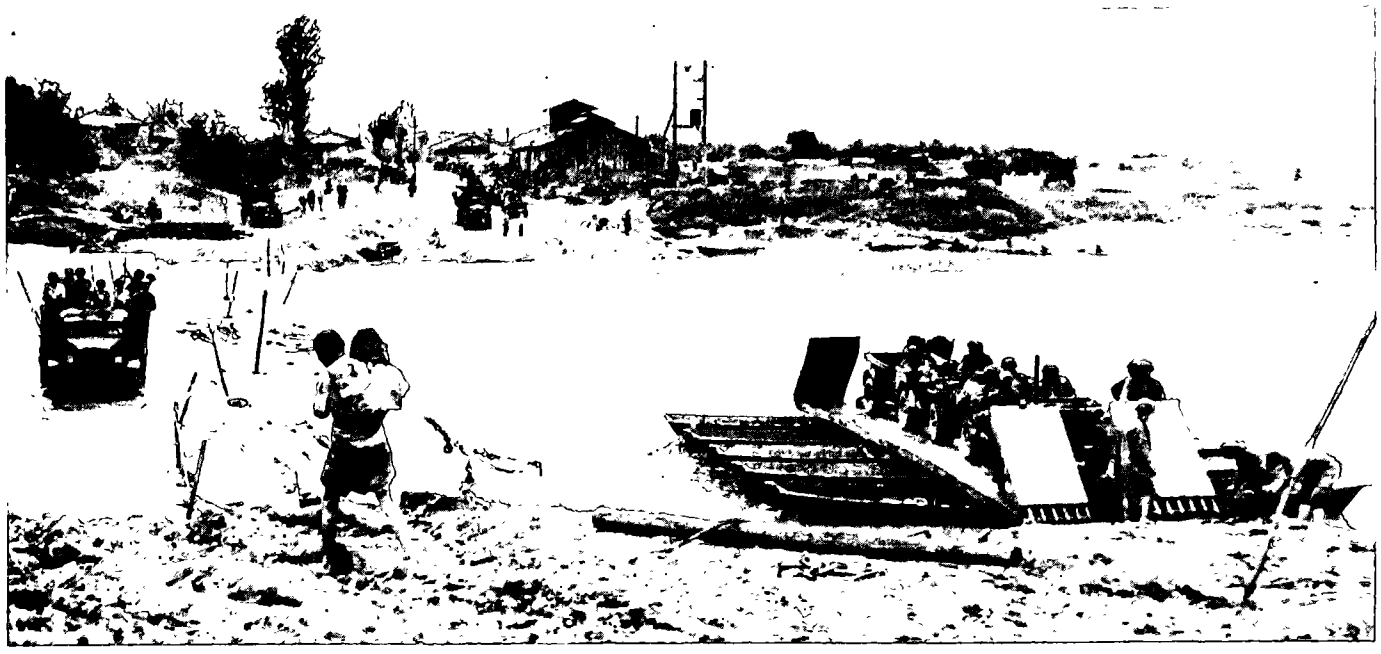


Figure H–4. Ferry and underwarter bridge.

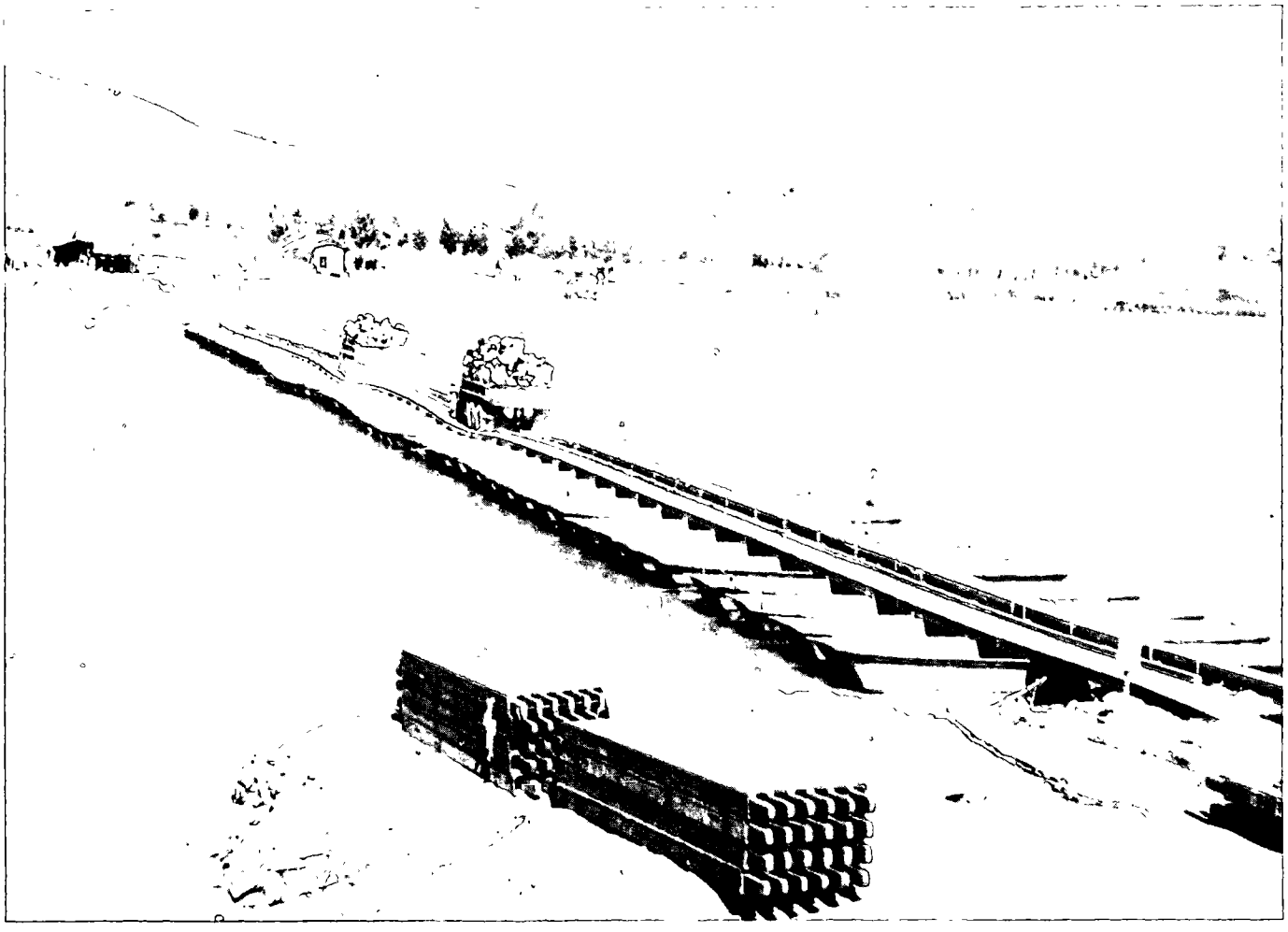


Figure H–5. Ponton bridge.

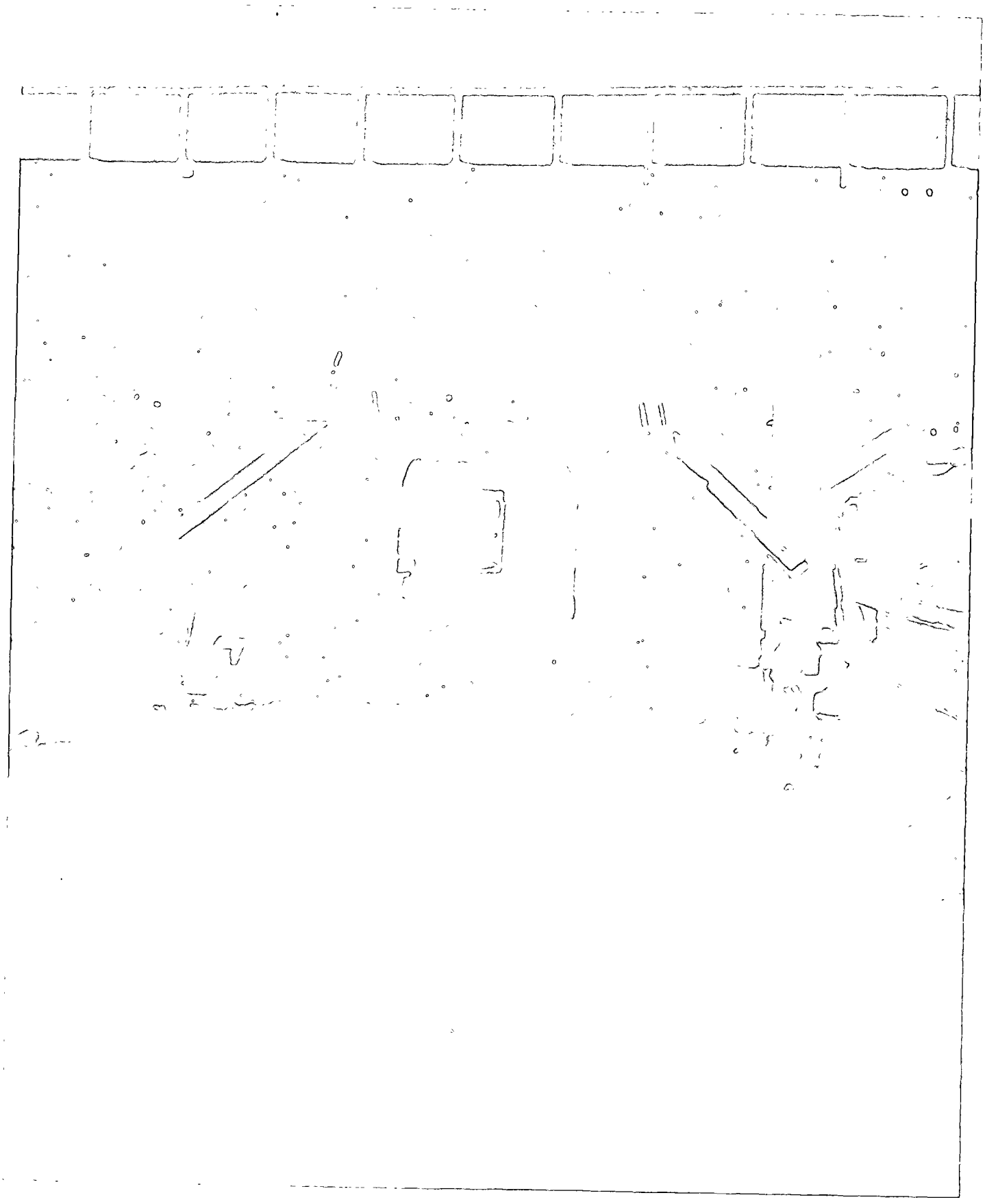


Figure H–6. Double underpass: a potential traffic bottleneck.

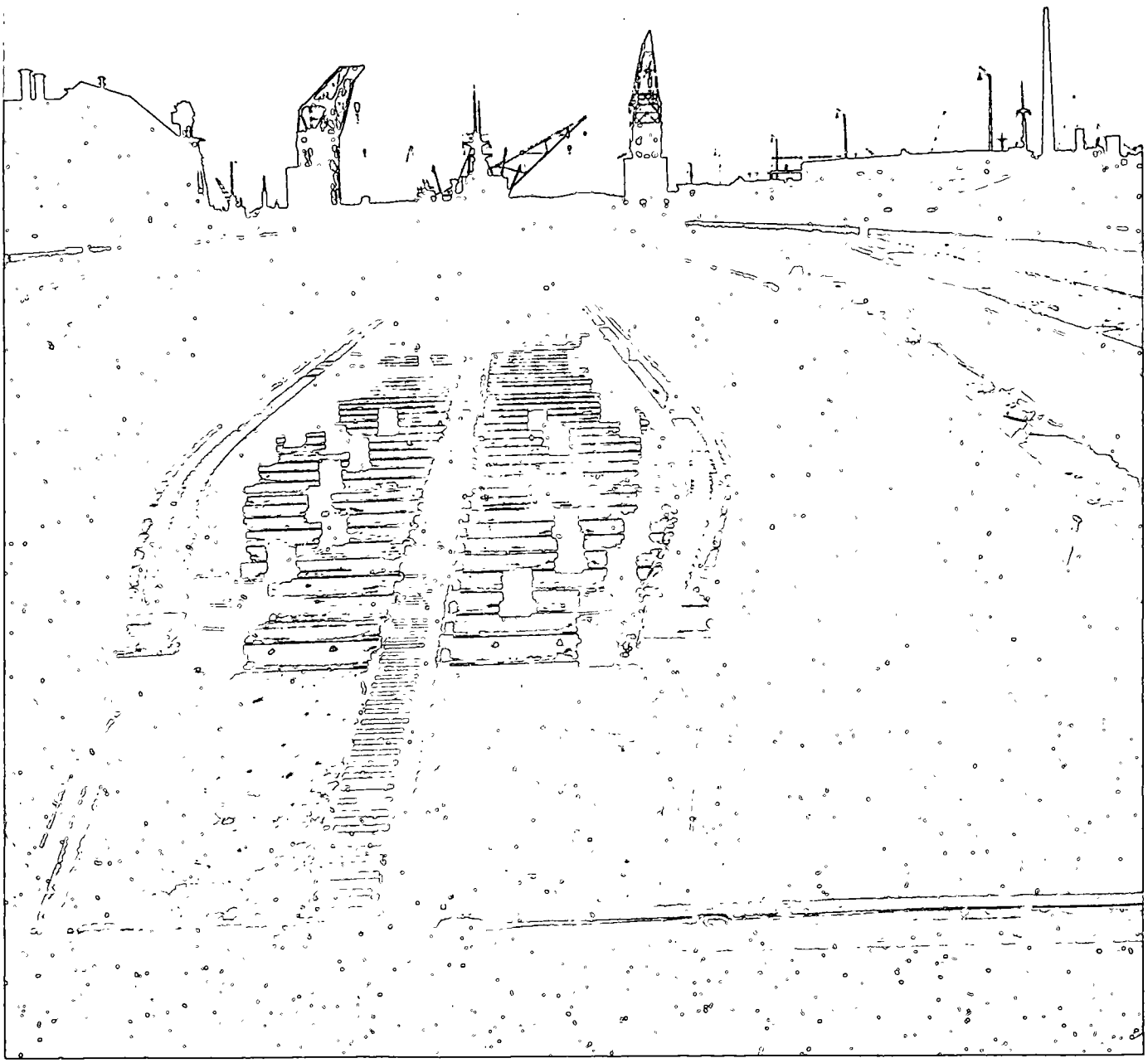


Figure H–7. Graving dock.

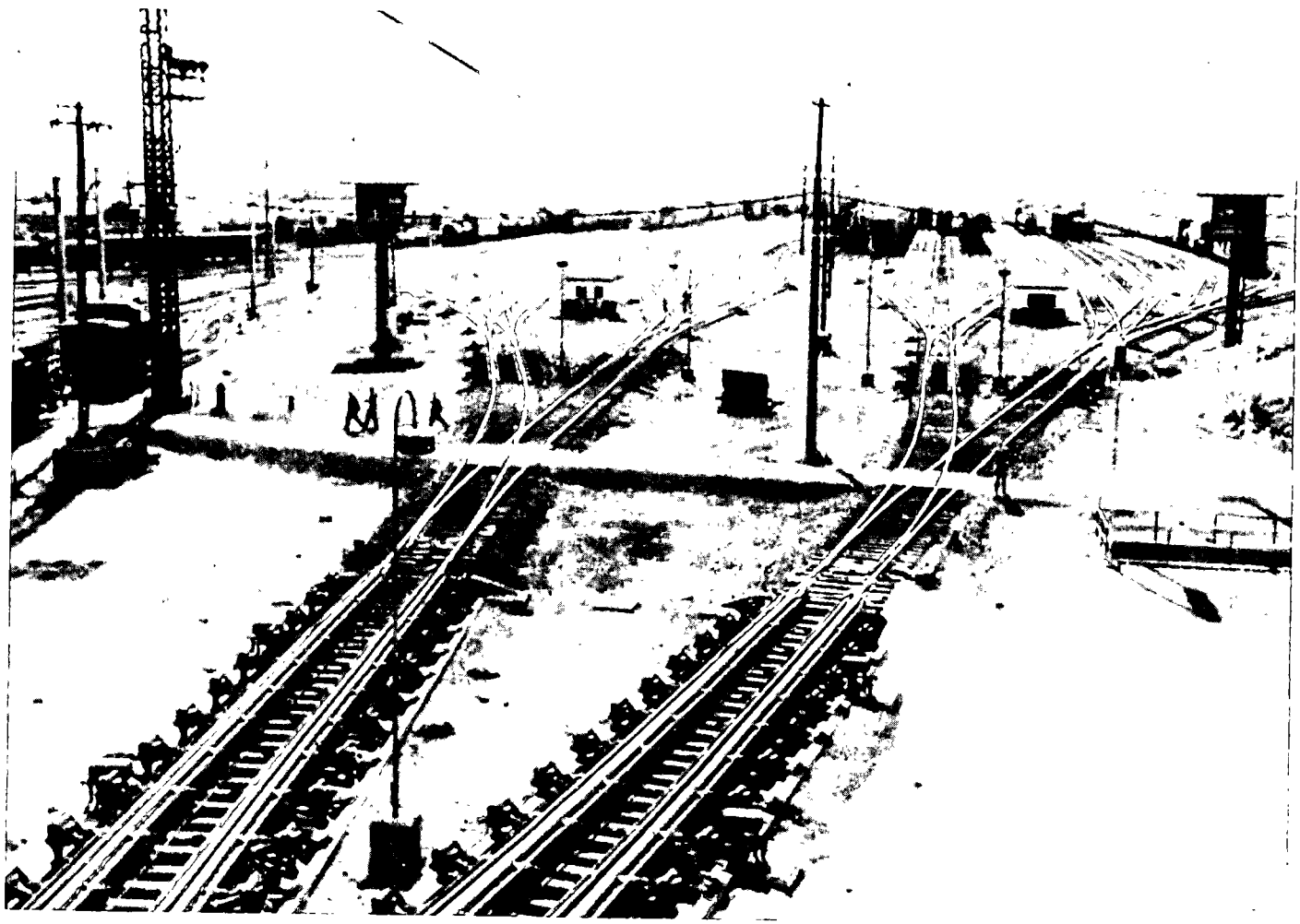


Figure H–8. Classification yard, showing retarders and track layout.

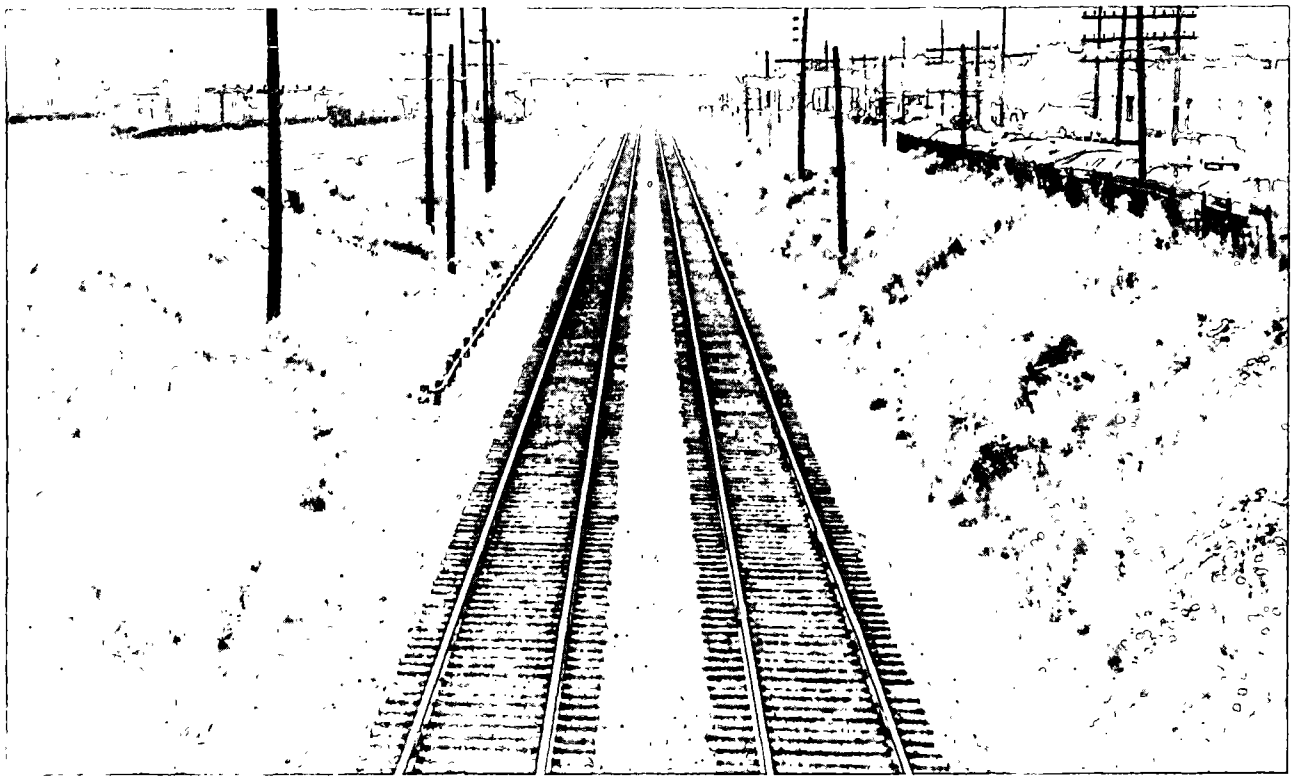


Figure H–9. Section of a main line, showing right-of-way and good maintenance.

Figure H–10. Closeups, showing condition of rail, ties, tie plates, and ballast.

APPENDIX I

SAMPLE INFORMATION REPORTING FORMATS

The formats shown in this appendix are suggested guides for reporting information. Because it is not possible to include all aspects of reporting on a form, extensive use should be made of the "remarks" column. If necessary, extension pages should be used to further clarify the reported information.

AIRFIELD CHARACTERISTICS	Name of facility: 60th Trans Bn (AAM)	Prepared by: R. E. Weber, Capt, TC, S2	Headquarters: 60th Trans Bn (AAM)	Page number: 1	Number of pages: 3
				Key: NA - not applicable	

Item number	Name and location	Type of airfield	Natural and artificial obstructions	Dispersal of aircraft	Maintenance facilities	Access roads	Administrative ground installations (housekeeping)
1	Rothstein Coord: 462713 on Map 12C	Heliport	50-ft obstacle (trees) at each end of both runways	Normal distance between acft in dispersal area is 50 yd	Field maintenance facilities for 40 acft	2 excellent asphalt roads (16 ft wide) from main highway 301	Semipermanent buildings (wooden) provide office, quarters, mess, and recreational facilities for 175 men. Utilities and sanitation facilities excellent. Adequate firefighting equipment, including chemical and water spray.

Item number	Runway and obstruction markers, etc.	Electronic navigational aids	Fuel and other storage facilities	Runways and taxiways	Loading, unloading, and warmup areas	Date and source of information	Remarks (permanency, diagram of facility, etc.)
1	Wind direction and lighting markers adequate for day or night operation	LF radio homer	Adequate POL storage for 2 day's operation without resupply. No covered storage areas available.	2 runways and 2 taxiways, asphalt construction; runways 900 ft long	Adequate. See attached sketch.	4 June 1969 463d Combat Engrs Reconnaissance Report	Permanent installation. See attached sketch of facility, drawn to scale (incl 1) and clarifying remarks (incl 2).

Additional remarks	Date: 4 June 1969	Typed name and grade: John P. Jones, Lt Col
		Signature:

Figure I-2. Airfield characteristics.

AIRCRAFT CHARACTERISTICS AND INVENTORY	Name of facility: 60th Trans Bn (AAM)	Prepared by: R. E. Weber, Capt, TC, S2	Headquarters: 60th Trans Bn (AAM)	Page number: 1	Number of pages: 1
				Key: NA - not applicable	

Item number	Type of aircraft	Number and location of each type	Make and model	Number deadlined (aprx)	Availability	Characteristics: Weight (lb) Basic	Weight (lb) Gross (max)	Overall dimensions (ft) Length	Overall dimensions (ft) Width	Overall dimensions (ft) Height	Cargo dimensions (in.) Doors Height	Doors Width	Doors Height from ground	Compartment Length	Compartment Width	Compartment Height	Description
1	Fixed wing	35 acft Coord: 4621 Map: 27D	Unk	5	30	3,400	5,000	31	48	11	40	40	48	70	50	52	Conventional, metal, high wing, single engine.
2	Helicopter	13 acft Coord: 4621 Map: 27D	Unk	3	10	8,300	13,000	66	56	14.5	54	50	35	130	58	68	Single engine, single main rotor, and antitorque tail rotor. All metal construction.

Item number	Performance data: Capacity Crew	Capacity Passengers* Troop seats	Capacity Passengers* Litters	External sling cap, max (lb)	Fuel Grade	Fuel Usable cap. (lb)	Fuel Consumption per hour (lb)	Takeoff distance w/gross wt (ft)	Speed (mph)	Payload, max (lb)	Cruising range, max (miles)	Remarks
1	1	5	2	NA	91/96	800	130	1,100	130	800	800	Similar to US L-20A.
2	3	17	8	3,900	100/130	1,500	470	490	140	3,200	450	Similar to US H-34A.

*Passenger capacity indicates troop seats or litters, depending upon how aircraft is employed.

Additional remarks

Information obtained on 3 June 1969 from PW formerly serving at the location cited.

Date: 4 June 1969

Typed name and grade: John P. Jones, Lt Col

Signature

Figure I–1. Aircraft characteristics and inventory.

WATERWAY CRAFT CENSUS - TRANSPORTATION INTELLIGENCE

NAME OF FACILITY: Dalgo Inland Waterways System

PREPARED BY: H. B. OKES, Captain, TC

HEADQUARTERS: 565th Trans Team (Intel, Coll), Trans. Sec., Hqs, 7th US Army

PAGE NUMBER: 3 | NUMBER OF PAGES: 5

KEY: NA - Not Applicable

TYPE OF CRAFT	NUMBER AVAILABLE	NAMES OF CRAFT	DISPLACEMENT (Short Tons)	MAXIMUM SPEED (Miles Per Hour)		TYPE AND POWER (Hp.)	SIZE (Ft. & In.)			CAPACITY		REMARKS
				UPSTREAM	DOWNSTREAM		LENGTH	BEAM	DRAFT	PASSENGER	CARGO (Short Tons)	
Motor barge	4	Alicia Juanita Maria J Pescado de Plata	1,200	13	16	Diesel - 1,000-hp	260'	36'	6½'	None	70-100	Capable of towing four barges
Ferry	3	El Capitano Monterrey Gorge I	1,000	9	12	Diesel - 325-hp	240'	35'	6'	40	450 tons, 15 railway cars	Four engines: two forward, two aft. Operates between Muy Malo, La Cucaracha, and Tomasino
Passenger	2	La Storma Don Eduardo	350	8	14	Steam	160'	22'	5'	500	None	Converted motor barges
Passenger	1	La Senora Blanca	1,500	9-11	17-16	Diesel - 1,000-hp	280'	38'	7'	800	None	Operates no farther upstream than Tomasino

ADDITIONAL REMARKS: Source of data - DALGO National Waterways Annual Report, Dec 1968; June 1969 operational status reports of army transportation units and G2 Interrogation Report, 13 May 1969

DATE: 24 June 1969

TYPED NAME AND GRADE: L. D. DURR, Lt Colonel, TC, Commanding

SIGNATURE: L. D. Durr

Figure I–3. Waterway craft census.

WATERWAY PHYSICAL CHARACTERISTICS - TRANSPORTATION INTELLIGENCE

PAGE NUMBER 1 | NUMBER OF PAGES 7

NAME OF FACILITY	PREPARED BY	HEADQUARTERS	MILE STATION 0.0 LOCATED AT OR NEAR	KEY
Barbo Waterway System	J. K. KEEBLE, Lt Colonel, TC, G2	115th Transportation Terminal Command (C)	Santa Cristina	NA - Not Applicable

ITEM	SECTION OF WATERWAY				TYPE OF WATERWAY	CHANNEL CHARACTERISTICS				NAVIGATION SEASON	
	FROM		TO			WIDTH (Ft.)	NORMAL CONTROLLING DEPTH (Ft.)	SAFE DRAFT (Ft.)	NORMAL CURRENT VELOCITY (Mph)	NORMAL OPENING DATE	NORMAL CLOSING DATE
	MILE STATION	NEAREST TOWN	MILE STATION	NEAREST TOWN							
1	0.0	Santa Cristina	36.5	Puerto Del Muerto	Canalized stream	350	8.5	7.0	3.0	1 March	15 December -- ice

ITEM	LOCKS				BRIDGES			SEASONAL INTERRUPTION		DATE AND SOURCE OF INFORMATION	REMARKS
	NUMBER	CONTROLLING DIMENSIONS (Ft.)			NUMBER	CONTROLLING CLEARANCE (Ft.)		REASON FOR INTERRUPTION (Floods, Low Water, Freezing, Etc.)	DATE OF INTERRUPTION		
		LENGTH	WIDTH	OEPTH OVER SILL		HORIZONTAL	VERTICAL				
1	2	136	21.3	9.0	4	67	19	Hurricanes and accompanying floods	17-20 July 1968	Reconnaissance June 1969 and operational reports 1 July 1968 - 30 June 1969	Navigable by 300-ton barges. Banks revetted with stone in all towns and near bridges

ADDITIONAL REMARKS

DATE: 3 August 1969

TYPED NAME AND GRADE: R. B. GATZ, Lt Colonel, TC, Adjutant General

SIGNATURE: R. B. Gatz

Figure I–4. Waterway physical characteristics.

CHARACTERISTICS OF WATERWAY LOCKS - TRANSPORTATION INTELLIGENCE

NAME OF FACILITY: Santa Cristina and Puerto Del Muerto Locks
PREPARED BY: H. C. PRICE, Captain, TC, S2
HEADQUARTERS: 59th Transportation Terminal Bn
PAGE NUMBER: 1
NUMBER OF PAGES: 1
NAME OF WATERWAY: Buena Fortuna River
MILE STATION 0.0 LOCATED AT OR NEAR: Santa Cristina
KEY: NA - Not Applicable

REFERENCE NO. ON MAP	LOCATION OF WATERWAY LOCKS		CHAMBER			ENTRANCE		GATES		LIFT (Ft.)	LOCKAGE TIME (Min.)	DATE AND SOURCE OF INFORMATION	REMARKS
	MILE STATION	NEAREST TOWN	CONSTRUCTION	LENGTH (Ft.)	WIDTH (Ft.)	WIDTH (Ft.)	DEPTH OVER SILL (Ft.)	TYPE AND CONSTRUCTION	POWER				
31	0.0	Santa Cristina	Reinforced concrete	145	27.7	22.7	9.5	Double-leaf miter, steel	Electric	7.3	23	National Waterway Navigation Bureau Report, January 1969 and recon June 1969	Santa Cristina lock on east bank; gates need extensive repairs
32	36.5	Puerto Del Muerto	Masonry	136	26.3	21.3	9.0	Double-leaf miter, timber	Manual	5.9	32	Do	Puerto Del Muerto lock on west bank; gates in poor condition

ADDITIONAL REMARKS

DATE: 20 June 1969
TYPED NAME AND GRADE: H. C. PRICE, Captain, TC, Adjutant
SIGNATURE: H. C. Price

Figure I–5. Characteristics of waterway locks.

CHARACTERISTICS OF INLAND WATERWAY PORTS - TRANSPORTATION INTELLIGENCE

NAME OF FACILITY: Buena Fortuna River

PREPARED BY: C. L. DRAKE, Major, TC, S2

HEADQUARTERS: 5th Transportation Terminal Command (A)

PAGE NUMBER: 1 | NUMBER OF PAGES: 10

KEY: NA - Not Applicable

ITEM NUMBER	MAP REFERENCE NUMBER	NAME AND COORDINATES	APPROACH CHANNEL		HARBOR			WHARFAGE		
			CONTROLLING DEPTH (Ft.)	AVERAGE WIDTH (Ft.)	TYPE	AREA (Acres)	DEPTH (Ft.)	TYPE AND CONSTRUCTION	TOTAL LENGTH (Ft.)	ALONGSIDE DEPTHS (Ft.)
1	8	Santa Cristina (00°00' N, 00°00' E)	8.5	350				Offshore timber wharf Offshore timber wharf Offshore timber wharf	900 490 400	9 8 7.5

ITEM NUMBER	STORAGE					CRANES		CLEARANCE		DATE AND SOURCE OF INFORMATION	REMARKS
	WAREHOUSES (1000's of Sq. Ft.)	OPEN (1000's of Sq. Ft.)	BULK GRAIN (1000's of Bushels)	COLD (1000's of Cu. Ft.)	BULK OIL (1000's of Barrels)	TOTAL NUMBER	HEAVIEST LIFT (Tons)	RAIL	HIGHWAY		
1	102	11.6	47.6	23.4	67.3	7	12	0	2	National Waterway Navigation Bureau Report, January 1969	Most important port on Buena Fortuna river. Good two-lane concrete road to El Toro, about 20 miles N; fair two-lane macadam road to La Bonita, 30 miles SE. In 1960 port handled 165,000 tons of imports and 213,000 tons of exports.

ADDITIONAL REMARKS

DATE: 6 June 1969

TYPED NAME AND GRADE: R. C. HOLT, Major, TC, Adjutant

SIGNATURE: R. C. Holt

Figure I-6. Characteristics of inland waterway ports.

VEHICLE CHARACTERISTICS AND INVENTORY - TRANSPORTATION INTELLIGENCE
(Passenger Cars, Buses, Trucks, Animal Drawn Vehicles, Major Items of Road Repair and Maintenance Equipment)

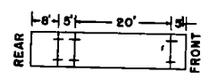
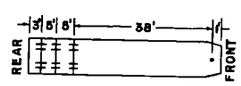
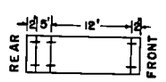
NAME OF FACILITY	PREPARED BY	HEADQUARTERS	PAGE NUMBER	NUMBER OF PAGES
ALFA National Highways System	B. B. BOYD, Colonel, TC, OPN S3	HHC 41st Transportation Highway Transport Command	1	3

KEY: NA - Not Applicable

A. CONVENTIONAL VEHICLES

TYPE OF VEHICLE	NUMBER OF EACH TYPE	MAKE	APPROXIMATE NUMBER DEADLINED	CAPACITY (Short Tons) OR NO. OF PASSENGERS	CARGO BED DIMENSIONS	BRAKE OR DEVELOPED ENGINE HORSEPOWER	PRINCIPAL FUEL USED	REMARKS
Trucks	300,000	Ford, Dodge, GMC	100,000	3/4 to 3	10'x7'x2' (3-ton)	110-150 brake	Gasoline	10 percent dump
	100,000	GMC International, Mack Autocar	15,000	5	14'x7'x7' 14'x7'x3'	170 brake	Gasoline	50 percent van 50 percent stake and platform
Buses	25,000	Autocar	1,000	32 pax	NA	170 brake	Gasoline	10 percent of these units can be converted to carry 8 stretchers by reducing the seating capacity to 24 persons
Trailers	5,000	Fruehauf	75	25	26'x7'x5'	NA	NA	
Semitrailers	4,500	Fruehauf	500	30	31'x7'x5'	NA	NA	Dollies are available for 3,000 units
Passenger cars	500,000	Ford, Dodge, Plymouth, Chevrolet, Pontiac	250,000	5 pax	NA	60-150 brake	Gasoline	The large number of vehicles deadlined is because of lack of repair parts - most of which must be imported

B. SPECIAL-PURPOSE VEHICLES

TYPE OF VEHICLE	NUMBER OF EACH TYPE	MAKE	OVERALL MEASUREMENT LENGTH	OVERALL MEASUREMENT WIDTH	OVERALL MEASUREMENT HEIGHT	NUMBER OF AXLES, THEIR SPACING, FRONT AND REAR OVERHANG	NO. OF WHEELS	NO. OF DRIVE WHEELS	TIRE SIZE	HORSE-POWER	GROUND CLEARANCE	TURNING RADIUS	CAPACITY AND CUBE	REMARKS
Tank truck	1,000	Autocar	38'	8'	8'		6	4	15.00 x 20	300 brake	18"	55'	5,000 gal.	
Heavy eqp trans low-bed semi-trailer	500	Hoff	52'	10'	NA		12	NA	16.00 x 21	NA	24"	NA	45 tons	
Truck tractor	800	Autocar	21'	9'	8'		6	4	16.00 x 21	300 brake	24"	80'	30 tons	150 provided with winch

ADDITIONAL REMARKS

DATE: 30 June 1969

TYPED NAME AND GRADE: M. K. LEAR, Lt Colonel, TC. Adjutant, S1

SIGNATURE: M. K. Lear

Figure I-7. Vehicle characteristics and inventory.

ROADWAY DATA - TRANSPORTATION INTELLIGENCE

(See Footnote 1 for explanation of Roadway)

NAME OF FACILITY: National Highway, Route 39

PREPARED BY: J. B. GAYLE, Major, TC, Opn S3

HEADQUARTERS: HHC 39th Transportation Truck Bn

PAGE NUMBER: 1 | NUMBER OF PAGES: 8

KEY: NA - Not Applicable

ROUTE NUMBER	SECTION	LOCATION (Origin and Destination)	DISTANCE (Miles)	PAVEMENT BASE TYPE	PAVEMENT BASE WIDTH (Ft.)	PAVEMENT BASE THICKNESS (In.)	PAVEMENT BASE CONDITION	PAVEMENT SURFACE TYPE	PAVEMENT SURFACE WIDTH (Ft.)	PAVEMENT SURFACE THICKNESS (In.)	PAVEMENT SURFACE CONDITION	SHOULDERS[2] TYPE	SHOULDERS[2] WIDTH (Ft.)	SHOULDERS[2] CONDITION	DATE AND SOURCE OF INFORMATION	REMARKS (Adequacy of base and drainage, bridges with restricting width and capacity, etc.)
39A	A	Klung to Welkenburg routes 60, 70, and 89	53	Macadam	20	6	Good	Bitumen	20	1-1½	Good	Earth	4	Good	Route recon 10 June 1969	
39	B	Welkenburg to Prentch, routes 60, 70 and 89	60	Macadam	22	8	Good	Asphalt	22	3	Good	Earth	4	Good	As above	Numerous short, shallow fords are on this section
39	C	Prentch to Flaggen, route 89	92	Earth	21	9	Good	Concrete	21	1-1½	Good	Earth	3.5	Good	Ministry of Transport Annual Report, July 1968	Fog and frost restrict traffic in winter months (Dec-Feb)
39	D	Flaggen to Campfen, route 89	52												As above	
		Mile 0 to Mile 12		Macadam	16	4	Good	Bitumen	16	1-1½	Good	Earth	5	Good		
		Mile 12 to Mile 42		Macadam	14	3	Fair	Crushed stone	14		Fair	Earth	3	Fair		
		Mile 42 to Mile 52		Macadam	18	6	Good	Asphalt	18	2	Good	Earth	4	Good		This section has a 9-inch telford subbase

[1] That portion of highwey bounded by outside line of shoulders or inside line of curbs and ordinarily used for vehicular traffic or parking.

[2] That portion of roedway bounded by edge of pavement surfece and inside line of ditch or top of slope.

ADDITIONAL REMARKS

DATE: 12 May 1969

TYPED NAME AND GRADE: J. T. BARRY, Major, TC, Adjutant, S1

SIGNATURE: J. T. Barry

Figure I-8. Roadway data.

BRIDGE DATA - TRANSPORTATION INTELLIGENCE

NAME OF FACILITY: National Highway, Route 39

PREPARED BY: J. T. Reed, Major, TC, Highway Traffic Engineer

HEADQUARTERS: 41st Transportation Highway Transport Command

PAGE NUMBER: 1 | NUMBER OF PAGES: 12

KEY: NA - Not Applicable

ROUTE NUMBER	SECTION	LOCATION OF BRIDGE	TYPE OF BRIDGE	OVERALL LENGTH OF BRIDGE (Ft.)	ROADWAY WIDTH (Ft.)	VERTICAL CLEARANCE ABOVE ROADWAY (Ft.)	STANDARD BRIDGE CLASSIFICATION	CLEAR HEIGHT[1] OF SPAN UNDER BRIDGE (Ft.)	SPANS			DETOURS AVAILABLE	DATE AND SOURCE OF INFORMATION	REMARKS (Bridges having low capacity, horizontal or vertical restrictions, other critical features, etc.)
									NUMBER	TYPE	LENGTH (Ft.)			
39	A	Mile 5.2 (5.2 miles N of Klung)	Concrete	330	20	Unlimited	35	25	7	Concrete	40' each	Stream fordable in dry weather	Route recon 1 May 1969	Over New River--deck girder bridge
39	A	Mile 21 (21 miles NW of Klung)	Stone masonry	400	25	Unlimited	40	20	8	Stone masonry	45' each	Bridge 0.5 mile upstream	As above	Over Old River--completed in 1958--arch-type structure
39	B	Mile 60 (Prentch)	Steel truss and concrete T-beam	670	19.7	14.8	24	20	1	Steel truss	178.8'	Rail bridge 0.3 mile downstream	As above	9-span, through-truss bridge over railway lines. Carries single-track electric carline extending along middle of structure; 4.9-ft walks
									3	Concrete T-beam	51' each			
									5	Concrete T-beam	57.9' each			

ADDITIONAL REMARKS

[1] *Bridge over water measured from normal water level*

DATE: 1 May 1969

TYPED NAME AND GRADE: L. D. MUIR, Lt Colonel, TC, Adjutant, S1

SIGNATURE: L. D. Muir

Figure I-9. Bridge data.

TRAFFIC BOTTLENECKS - TRANSPORTATION INTELLIGENCE
(Tunnels, Narrow Streets, Sharp Curves, Steep Grades, Switchbacks, Underpasses, Ferries, Fords, Etc.)

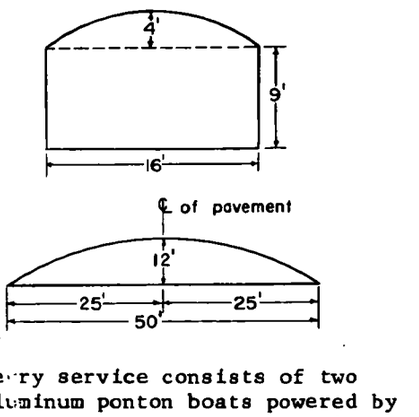
NAME OF FACILITY: National Highway, Route 39

PREPARED BY: C. L. POST, Captain, TC, Highway Regulating Officer

HEADQUARTERS: 41st Transportation Highway Transport Command

PAGE NUMBER: 1 | NUMBER OF PAGES: 3

KEY: NA - Not Applicable

ROUTE NUMBER	SECTION	LOCATION	TYPE	LENGTH (Ft.)	ROADWAY WIDTH (Ft.)	VERTICAL CLEARANCE (Ft.)	MAXIMUM GRADES (Percent)	MINIMUM CURVE RADIUS (Ft.)	DETOURS AVAILABLE	DATE AND SOURCE OF INFORMATION	REMARKS
39	A	Mile 12.5 (12.5 miles NW of Klung)	Sharp turn		10	NA		See remarks	Village bypass 3 miles E	Route recon 10 June 1969	90° turn in village.
39	A	Mile 27 (27 miles NW of Klung)	Narrow bridge	150	10.5	Unlimited	See remarks	See remarks	Ford adjacent to structure at low water	As above	East approach to bridge is on a 10 percent grade; west approach has 90° turn. Bridge class 4.
39	A	Mile 39 (39 miles NW of Klung)	Tunnel	4,865	16	See remarks	NA	NA		As above	
39	B	Mile 10.5 (10.5 miles N of Welkenburg)	Series of reverse curves and steep grades	1,000	14	NA	10	See remarks	None	Route recon 15 June 1969	
39	C	Mile 71 (71 miles NE of Prentch)	Ferry	1,000	NA	NA	NA	NA	None	Ministry of Transport Annual Report, July 1968	Ferry service consists of two aluminum ponton boats powered by outboard motors--capacity, 3 tons (1 passenger car); crossing time, 1 to 2 hours.
39	D	Mile 15 to Mile 16 (15 miles N of Flaggen)	Long grade (ascent)	7,300	14	NA	8		None	As above	
39	D	Mile 17 (17 miles N of Flaggen)	Mountain pass		14	NA			Parallel route, 30 miles west	As above	Road subject to snow blocks for 1- to 10-day periods, Dec-Feb; elev, 5,500 ft.
39	D	Mile 46.5 to Mile 47 (46.5 miles N of Flaggen)	Flood waters	Aprx 2,500	NA	NA	NA	NA		As above	Road subject to flooding of 1 to 5 ft during heavy spring rains; water depth markers placed along each side of roadway.

ADDITIONAL REMARKS

DATE	TYPED NAME AND GRADE	SIGNATURE
2 July 1969	J. T. ILES, Lt Colonel, TC, Adjutant, S1	J. T. Iles

Figure I-10. Traffic bottlenecks.

CHARACTERISTICS OF PORTS AND TERMINAL FACILITIES - TRANSPORTATION INTELLIGENCE

NAME OF FACILITY: Dalgo East Coast Ports and Harbors

PREPARED BY: R. C. MANN, LTC, TC, G2

HEADQUARTERS: 115th Transportation Terminal Command

KEY: NA - Not Applicable

PAGE NUMBER: 5

NUMBER OF PAGES: 10

NAME AND COORDINATES	TYPE OF HARBOR	TIDES AND WEATHER CONDITIONS	NUMBER, TYPE AND LOCATION OF ANCHORAGE [1]	NATURAL AND ARTIFICIAL OBSTRUCTIONS	HARBOR AREA (Acres)	ACREAGE HARBOR DEPTH (Ft.)	MINIMUM CHANNEL DEPTH (Ft.)	WHARVES: TOTAL LENGTH (Ft.)	WHARVES: DEPTH ALONGSIDE (Ft.)	NUMBER AND CLASSIFICATION OF ALONGSIDE BERTHS [2]	COVERED STORAGE CAPACITY: TRANSIT SHEDS (Sq. Ft.)	COVERED STORAGE CAPACITY: WAREHOUSES (Sq. Ft.)	COVERED STORAGE CAPACITY: CDLD STORAGE (Sq. Ft.)	BULK STORAGE
FERTANN 00 00' N 00 00' E	Improved natural harbor at mouth of East River	MHW interval: 4 hr, 13 min MHWS, 23.6' MHWN, 19.3' Ice: no hindrance to navigation Fog: prevalent, Dec-Feb	Unlimited anchorage 2 miles beyond mouth of East River Three class II free-swinging berths in harbor Five class II fixed berths at mooring buoys	675-ft N-S breakwater 545-ft E-W breakwater	12	5-15	30 ft to entrance	1,500 2,100 75 1,240	28 21 25 7-10	3 B 4 C 1 T-C 10 F	151,350	257,400	7,500	Grain: 151,000 bu Vegetable oil: 17,000 bbl Coal: 40,000 tons

NAME AND COORDINATES	OPEN STORAGE CAPACITY	MECHANICAL HANDLING FACILITIES	PORT CLEARANCE FACILITIES (Rail, Highway, Inland Waterway, Air) [3]	ESTIMATED PORT CAPACITY (Long Tons per 20-hr. Day): UNLOADING	ESTIMATED PORT CAPACITY (Long Tons per 20-hr. Day): CLEARANCE	PETROLEUM STORAGE CAPACITY (Bbl.)	REPAIR FACILITIES	NAVAL FACILITIES (Brief Listing)	DATE AND SOURCE OF INFORMATION	REMARKS (Silting, Dredging, Underwater Obstructions, Navigation Hazards, Pilotage, Etc.)
FERTANN 00 00' N 00 00' E	9.3 acres adjacent to waterfront 33 acres 3 miles from port on road to MIKE	Thirteen 3½- to 6-ton traveling electric portal cranes One 15-ton traveling electric portal crsne Three 6-ton bridge transporters Two 75-ft conveyor belts One 40-ton floating crane	Rail: One double-trsck standard-gage line to ALFA, about 35 miles NW. One single-track, meter-gage line to BRAVO, about 25 miles SW; single-track branch at NOVEMBER to GOLF Highway: Two-lane concrete road, good condition, to ALFA, about 15 miles SE. Two-lane macadam road to MIKE, 20 miles N Water: Via East River to VICTOR, 50 miles E, for 9-ft-draft craft Air: Municipal airport 3 miles from city; runway capable of supporting C-47's; one standard gage railway spur connecting with line at ALFA, 1½-miles from city limits	4,900	6,200	435,000	Two graving docks: 502'x65' 236'x47' One floating drydock can accommodate vessel 460'x 53' Three marine railways with maximum cradle length of 311' Major repairs can be made to all vesaels not exceeding graving dock length	Fontlen Yards--principal supply snd repairs base in country	Operations report, 15 April 1969	Vessels entering FOXTROT basin are restricted by XRAY lock to length 400', width 50', draft 20'

[1] CLASSIFICATION OF ANCHORAGE BERTHS

CLASS	MINIMUM DIMENSIONS: DIAMETER (Yds.)	MINIMUM DIMENSIONS: DEPTH (Ft.)	TYPE OF VESSEL
I	OVER 900	OVER 40	C5 and larger class vessels
II	900-800	40-36	C4 class vessel
III	800-500	36-30	Victory class cargo vessel
IV	500-300	30-20	Small cargo vessels

Increased diameters are required for depths exceeding the minimum for each class. Each anchorage should be evaluated in terms of protection from sea and weather.

[2] CLASSIFICATION OF ALONGSIDE BERTHS

GENERAL: CLASS	GENERAL: BERTH DIMENSIONS (Ft.) LENGTH	GENERAL: BERTH DIMENSIONS (Ft.) DEPTH	TANKER: CLASS	TANKER: BERTH DIMENSIONS (Ft.) LENGTH	TANKER: BERTH DIMENSIONS (Ft.) DEPTH
A	605	34-32	T-A	750	40
B	565	31-30	T-B	650	36
C	460	29-23	T-C	600	34
D	350	22-18	T-D	525	31
E	250	17	T-E	450	26
F	200	13	T-F	250	14
G	100	7	T-G	175	9

[3] Include brief summary of air transport facilities which add to port clearance capability.

None

TYPED NAME AND GRADE: R. C. MILLS, LTC, TC, Adjutant General

SIGNATURE: R. C. Mills

DATE: 25 July 1969

Figure I–11. Characteristics of ports and terminal facilities.

CHARACTERISTICS OF BEACHES AND LANDING AREAS - TRANSPORTATION INTELLIGENCE	NAME OF FACILITY: Marlin Area Beaches	PREPARED BY: J. B. MORTON, CPT, MI	HEADQUARTERS: 30th Technical Intelligence Company	KEY: NA - Not Applicable	PAGE NUMBER: 3	NUMBER OF PAGES: 7

BEACH NUMBER AND LOCATION	LENGTH OF BEACH		WIDTH OF BEACH		BEACH GRADIENTS		APPROACH (*Bottom gradients, water depths, winds, reefs, etc.*)	SURF AND TIDAL RANGE	MATERIAL AND FIRMNESS	DESCRIPTION OF TERRAIN IMMEDIATELY BEHIND BEACH	EXITS AND COMMUNICATIONS INLAND
	OVERALL LENGTH	USABLE LENGTH	LOW WATER	HIGH WATER	LOW WATER TO HIGH WATER	HIGH WATER ZONE					
No. 22. Centered 600 yd NE of Leander and 8.6 mi SW of Ocean View at 11°12' N, 22°22' E	2,000 yd	All usable	Aprx 30 yd	Aprx 20 yd	Aprx 1 in 30	1 in 20	Near shore bottom slopes flat; 2.4-to 4.6-ft depths 30 yd offshore; 6.8-ft depth 400 yd SW end 700 yd off SE end of beach. Approach from NW and bay generally clear over shoal depth with some rocky patches. Approach flanked on SE by small islands, reefs, and rocks, which extend for about 2 miles NW of Leghorn. Bottom mud and sand; weedy close to shore.	Surf rough with prevailing northerly winds; tidal range 1.0 ft, spring tides.	Sand: soft and fine; firm only in wetted area.	Soft, sandy backshore generally unsuitable for wheeled vehicles, backed by a sea wall and 900 yd of sand hummocks 4.6 ft high, covered with brush; all on a flat, open plain.	Across 900 yd sandy terrain by narrow one-lane road to a primary road and railroad leading to Leander.
No. 12 Seaview to Lakeland; centered 22°26' N, 33°36' E. On sandspit terminated on W by entrance channel into Lake Yerba	5.2 miles	4.6 miles usable	Aprx 85 yd	Aprx 50 yd	Aprx 1 in 50	1 in 50	Near shore bottom slopes mild to flat; 6-ft depth generally 160 yd off beach except at W end where 400 yd offshore; 18-ft depth 2.0 miles offshore; approach clear over gradually shoaling sand and mud bottom; 30-ft anchorage 4.0 mile offshore E of breakwater. Bottom hard sand.	Surf rough with onshore winds; tidal range aprx 1.6 ft, spring tides.	Sand and sandstone--believed to be firm.	Low sand dunes backed by hilly sandy terrain as high as 40 ft and completely covered with vegetation; terrain directly back of beach flanked on E and W by vast salt marshes.	A primary road parallels the shore about 2.0 miles inland; railroad parallels the shore 3 miles from beach. Cross-country exit across dune area to network of minor roads or trails connecting with secondary road, connecting with primary road at Hilldale

REMARKS

NOTE: Beach lengths and distances along the coast and inland are expressed in statute miles; distances across water are expressed in nautical miles except when referring to beach locations.

DATE	TYPED NAME AND GRADE	SIGNATURE
27 February 1969	J. B. MORTON, CPT, MI	

Figure I-12. Characteristics of beaches and landing areas.

CHARACTERISTICS OF WHARVES
TRANSPORTATION INTELLIGENCE

NAME OF FACILITY: Port of Rusnak

PREPARED BY: C. D. KEENE, Captain, TC, S2

HEADQUARTERS: 520th Transportation Terminal Bn

PAGE NUMBER: 1 | NUMBER OF PAGES: 5

KEY: NA - Not Applicable

REFERENCE NUMBER ON PORT PLAN AND NAME OF PIER	USE OF WHARVES	TYPE AND CONSTRUCTION	DIMENSIONS (Segments or Sides) (Ft.)		DEPTH ALONGSIDE MLW (Ft.)	HEIGHT OF DECK ABOVE MLW (Ft.)	NUMBER AND CLASSIFICATION OF BERTHS (See Table Below)	MECHANICAL HANDLING FACILITIES (Conveyors, Trucks, etc.)	OPEN STORAGE TYPE SURFACE (Sq. Ft.)	COVERED TRANSIT OR STORAGE		CLEARANCE (Rail and Road Connection)	UTILITIES
			USABLE LENGTH	WIDTH WHARF APRON						NUMBER OF BUILDINGS	GROSS FLOOR AREA (Sq. Ft.)		
7. Water Shipping Company Quay	Transfer of general cargo	Quay: reinforced concrete face; earth fill with bituminous surface	1,500	55	28	5		Six 6-ton and one 15-ton traveling cranes.		6	60,000	Rail: single flush track along quay face; one additional track behind transit shed. Road: truck access to quayside.	Water: by quay hydrant at 10 tons per hour. Electricity: quay poorly lighted; power available to vessels.
11. XYZ Petroleum Pier	Receipt of petroleum products	T-head pier: timber deck on wood piles; approach 20'x275'; T-head 25'x75'. Three dolphins, alined with face, spaced 50' apart on each side of T-head	75	Open	25	7		One 1½-ton fixed electric jib crane. One 8-in. pipeline for discharge of gasoline; one 6-in. for discharge of fuel oil		1	N/A	Rail: none. Road: limited truck access to shipside.	Water: none. Electricity: pier poorly lighted.

REMARKS (Dimensions, capacity, limiting factors, etc.)

7. All transit sheds are 1-story, 50'x200' brick buildings equally spaced along quay. Entrance N transit shed to be replaced by 2-story 75'x250' reinforced concrete building in October 1961.

11. Pier serves XYZ Company tank farm of 21 tanks, each 40' in diameter and 50' high (capacity, each 11,000 bbl), 500 yd directly behind root of pier.

CLASSIFICATION OF BERTHS

GENERAL CLASS	BERTH DIMENSIONS (Ft.) LENGHT	DEPTH	TANKER CLASS	BERTH DIMENSIONS (Ft.) LENGTH	DEPTH
A	605	34-32	T-A	705	40
B	565	31-30	T-B	650	36
C	460	29-23	T-C	600	34
D	350	22-18	T-D	525	31
E	250	17	T-E	450	26
F	200	13	T-F	250	14
G	100	7	T-G	175	9

TYPED NAME AND GRADE: C. D. KEENE, Captain, TC, S2

SIGNATURE

DATE: 21 June 1969

Figure I-13. Characteristics of wharves.

CRANE CHARACTERISTICS AND INVENTORY - TRANSPORTATION INTELLIGENCE

NAME OF FACILITY: Port of Blazada

PREPARED BY: H. C. MILES, Captain, TC

HEADQUARTERS: 904th Trans Team (Intel, Collection) Trans Sec, Hqs 3d Corps, 1st Army

KEY: NA - Not Applicable

PAGE NUMBER: 1

NUMBER OF PAGES: 1

NUMBER AND TYPE OF CRANES	TYPE OF POWER	DIMENSIONS: LIFT (Tons)	DIMENSIONS: RADII MAXIMUM	DIMENSIONS: RADII MINIMUM	DIMENSIONS: OUT REACH BEYOND WHARF FACE	DIMENSIONS: HOIST ABOVE WHARF	DIMENSIONS: HOIST BELOW WHARF	SPEEDS (Per Minute): LIFTING	SPEEDS (Per Minute): LUFFING	SPEEDS (Per Minute): SLEWING (Revolutions)	SPEEDS (Per Minute): TRAVELING	BASIC MOTIONS	PORTAL CLEARANCE: HEIGHT	PORTAL CLEARANCE: WIDTH	TRACK: LENGTH	TRACK: GAGE	MAKE	CONDITION	LOCATION	REMARKS
ASHORE:																				
5 portal jib cranes	Electric	5 1.5	NA 55'	30' NA	41.5' NA	60' NA	36' NA	120' 180'	200'	1.5	40'	Slewing (360°), luffing, hoisting, traveling	13'	14'	425'	15'	Applevage	Fair	South Quay, New Basin	Serves Berth No. 1 Use: General cargo
2 locomotive cranes	Steam	6 3	NA 26'	13' NA	20.0' NA	31' 26'	26'	200'	250'	3	300'	Slewing (360°), luffing, hoisting, traveling	NA	NA	840'	105 cm	Levquen	Fair	South Quay, New Basin	Serves all berths Use: All-purpose
1 gantry crane	Electric	10	NA	NA	NA	16'	NA	250'	NA	NA	250'	Hoisting, traveling, racking	18'	28'	200'	29.5'	Dravo	Good	Rehandling area south of South Quay	Use: Rehandling general cargo
2 mobile jib cranes	Gasoline	5	30'	15'	NA	40'	NA	185'	220'	5	20 mph	Slewing (360°) luffing, hoisting, traveling	NA	NA	NA	NA	Acro	Excellent	Lighter wharf	Use: All-purpose
AFLOAT:																				
1 floating jib crane (self-propelled)	Steam	25 10	NA 75'	55' NA	NA	60'	NA	32.3'	30'	.7	NA	Slewing (360°), luffing, hoisting	NA	NA	NA	NA	Craven	Poor, limited to 15 tons	NA	Hull: 48' by 110' Draft: fwd--3' aft--5.3'
1 floating crane	Steam	10	Fixed at 23' from edge of ponton		NA	25'	NA	28'	20'	NA	NA	Luffing, hoisting	NA	NA	NA	NA	Butler		NA	Hull: 40' by 90' Draft: fwd--1.2' aft--2.0'

ADDITIONAL REMARKS

4 bridge transporters (electric) available ashore. Dimensions of each: Span (overall) 287'; cantilever (over berth) 100'; grab capacity, 2 tons; trolley travel--speed 200'/min, along bridge 187', along cantilever 80', outreach from wharf face 50.5'; hoist--above wharf 60.7', below wharf 28', handling capacity 60 tons/hr.

DATE: 13 June 1969

TYPED NAME AND GRADE: B. T. PARKER, Major, TC, Commanding

SIGNATURE: B. T. Parker

Figure I–14. Crane characteristics and inventory.

WAREHOUSE DATA - TRANSPORTATION INTELLIGENCE

NAME OF FACILITY: Port of Rusnak

PREPARED BY: C. R. BRIGGS, Captain, TC, Commanding

HEADQUARTERS: 760th Transportation Depot Co.

PAGE NUMBER: 1 | NUMBER OF PAGES: 4

KEY: NA - Not Applicable

NAME AND NUMBER OF WAREHOUSE	LOCATION OF WAREHOUSE	OWNER AND OPERATOR	USE	TYPE OF CONSTRUCTION	DIMENSIONS (Ft.)	FLOOR DATA			
						NUMBER OF FLOORS	HEIGHT BETWEEN FLOORS	FLOOR LOAD CAPACITY	TOTAL USABLE FLOOR AREA (Sq. Ft.)
Customs Building No. 2	South Quay, New Basin	Port Authority	General cargo, imports (transit shed: goods must be cleared within 6 days)	Brick walls, tile roof, stone tile floor	196'x196'	One	16 ft to eaves	600 lb per sq ft	38,400 sq ft
Weems & Co Warehouse	200 ft S of South Quay, Old Basin	Weems & Co	Building materials	Steel frame, corrugated iron sides and roof, cement floor	Irregular, 155'x245'	One (15 bays)	17.5 ft to eaves	525 lb per sq ft	37,390 sq ft
Bonded Warehouse No. 1	Southwest Quay, New Basin	Port Authority	General stores	Brick walls; tile roof; cement ground floor, wooden upper floors	100'x160'	Three	Ground floor, 15 ft 1st floor, 14 ft 2nd floor, 12 ft	Ground floor, unlimited 1st floor, 300 lb per sq ft 2nd floor, 205 lb per sq ft	42,653 sq ft

NAME OR NUMBER OF WAREHOUSE	TOTAL CAPACITY	RAIL CONNECTIONS	ROAD CONNECTIONS	LOADING PLATFORMS	SPECIAL HANDLING EQUIPMENT	FIRE PROTECTION
Customs Building No. 2	9,500 tons general cargo	Two tracks, front and rear of shed	Paved wharf apron front building; no access to rear and sides because of surface (open) rail tracks	Car floor level platform along entire length of front, 14 ft wide by 2 ft 10 in. high	Eight 2-ton telfers	Grinnell automatic system; fire hydrants, water buckets
Weems & Co Warehouse	11,000 tons building materials	Two tracks in front of shed	Truck access via 19-ft-wide macadam roadway; 12-ft-wide gravel road skirts building	None	One 2-ton forklift; one 5-ton forklift	Fire hydrants, hand extinguishers
Bonded Warehouse No. 1	8,100 tons general cargo	One siding in front	Paved apron fronts shed; 24-ft-wide concrete road passes rear of shed	None	Ground floor, four 2-ton telfers 1st floor, two 2-ton telfers 2nd floor, two 1-ton pivoting wall cranes	Grinnell automatic system; sand and water buckets

REMARKS

DATE: 7 April 1969

TYPED NAME AND GRADE: C. R. BRIGGS, Captain, TC, Commanding

SIGNATURE: C. R. Briggs

Figure I-15. Warehouse data.

RAILROAD LINE CHARACTERISTICS & FACILITIES - TRANSPORTATION INTELLIGENCE

NAME OF FACILITY: Shiloh National Railways

PREPARED BY: M. B. YOKES, Colonel, TC, G2

HEADQUARTERS: 2nd GHQ, Trans Railway Service

PAGE NUMBER: 1 | NUMBER OF PAGES: 5

KEY: NA - Not Applicable

RAIL LINE NUMBER	TERMINALS BY DIVISIONS	ROUTE MILES			TOTAL TRACK MILES	RULING GRADE (Percent)		MINIMUM RADIUS OF CURVATURE (Feet)	AXLE LOAD LIMIT (Short Tons)	RAILS		BALLAST			TIES			BRIDGES		TUNNELS	
		SINGLE	DOUBLE	TOTAL		GOING	RETURNING			WEIGHT (Lbs. per Yd.)	LENGTH (Ft.)	TYPE	SIZE (Diameter)	DEPTH (In.)	TYPE	SIZE	SPACING (Per Mile)	NUMBER	TOTAL LENGTH (Feet)	NUMBER	TOTAL LENGTH
1	Louisville-Clagg	0.0	25.6	25.6	68.7	1.6	1.4	955	30.0	131	33	Gravel	NA	9	Untreated oak	6"x8"x8' 6"	2,880	4	350	0	NA
	Clagg-Boyd	56.2	0.0	56.2	75.4	1.0	0.8	1,433	30.0			Broken stone	2½"	9	Treated pine		2,880	7	935	1	2,875
2	Seymour-Reed	43.8	0.0	43.8	57.6	1.2	1.5	1,146	30.0	133	39	Broken stone	2½"	12			2,880	6	550	0	NA
	Reed-Dale	39.4	6.3	45.7	64.8		1.3	1,433	30.0	133	39	Broken stone	2½"	12	Untreated oak	6"x8"x8' 6"	2,880	2	180	0	NA

RAIL LINE NUMBER	PASSING TRACKS		CLASSIFICATION YARDS		FUELING FACILITIES		WATERING FACILITIES			REPAIR SHOPS			SIGNALS AND TRAIN CONTROL	TRAIN DISPATCHING	TYPE OF MOTIVE POWER	AVERAGE NUMBER OF TRAINS EACH WAY PER 24 HOURS	
	MAXIMUM DISTANCE (Miles)	MINIMUM LENGTH (Feet)	LOCATION	CAPACITY (Cars per 24 Hours)	LOCATION	TYPE	LOCATION	SOURCE	CAPACITY	LOCATION	TYPE	CAPACITY				FREIGHT	PASSENGER
1	16.3	1,150	Louisville	5,000	Louisville	Coaling trestle	Louisville	City supply	100,000 gal. per day	Louisville	Locomotives and freight cars	12 locos 45 cars	Manual blocking with semaphore signals	Telephone from Louisville	Steam	17	5
	5.4	1,650	None	NA	Boyd	Hand shoveling	Boyd	City supply	2,000 gal. per hr	None	NA	NA	Do	Do	Do	7	5
2	6.8	1,650	Seymour	3,500	Seymour	Coaling trestle	Seymour	City supply	3,000 gal. per hr	None	NA	NA	Automatic blocking with position lights	Telephone from Seymour	Do	8	6
							Reed	Pumped from river	50,000 gal. per day								
	4.7	1,340	Dale		Dale	Coaling trestle	Dale	City supply	40,000 gal. per day	Dale	Locomotives and freight cars	15 locos 50 cars	Do	Do	Do	8	6

REMARKS

DATE: 30 June 1969

TYPED NAME AND GRADE: J. K. NOKES, Lt Colonel, TC, Adjutant

SIGNATURE: J. K. Nokes

Figure I–16. Railroad line characteristics and facilities.

LOCOMOTIVE CHARACTERISTICS AND INVENTORY - TRANSPORTATION INTELLIGENCE

NAME OF FACILITY: Shiloh National Railways

PREPARED BY: T. L. MAPES, Colonel, TC, G2

HEADQUARTERS: 1st GHQ Trans Railway Service

PAGE NUMBER: 1 | NUMBER OF PAGES: 3

KEY: NA - Not Applicable

SERIES NUMBER	WHEEL ARRANGEMENT	NUMBER IN SERVICE	MANUFACTURER	YEAR BUILT	TRACTIVE EFFORT (Lbs.)	ADHESIVE WEIGHT (Short Tons)	TOTAL WEIGHT OF ENGINE AND TENDER IN WORKING ORDER (Short Tons)	MAXIMUM AXLE LOAD (Short Tons)	DIAMETER OF DRIVING WHEEL (In.)	CYLINDERS			BOILER PRESSURE (Lbs/Sq. In.)	DRIVING WHEEL BASE (Ft. & In.)	TOTAL WHEEL BASE OF ENGINE & TENDER (Ft. & In.)	TOTAL LENGTH OF ENGINE & TENDER (Ft. & In.)	TENDER CAPACITIES			REMARKS
										NUMBER	DIAMETER (In.)	STROKE (In.)					WATER (Gal.)	COAL (Short Tons)	OIL (Gal.)	
A1	2-8-4	65	Lima	1926	69,800	124.75	293.8	32.5	63"	2	28	30	220	16' 6"	75' 8½"	87' 1"	9,600	16	NA	Steam
H5	2-8-2	323	Lima	1938	48,570	107.75	217.25	26.9	63"	2	25	32	180	16' 6"	67' 4½"	77' 8½"	8,000	12	NA	Do
I40	4-4-2	3	American Locomotive Co	1932	20,810	47.9	159.7	24.0	69"	2	19	26	180	7' 0"	58' 5 5/8"	67' 10 1/8"	7,500	14	NA	Do
KJ	4-6-2	16	Do	1921	28,520	77.5	199.15	25.8	75"	2	22	26	200	13' 0"	65' 1½"	74' 8 7/8"	8,000	13½	NA	Do
M1	0-10-0	3	Do	1933	55,360	138.5	213.45	29.5	52"	2	24	28	210	19' 0"	54' 7½"	69' 10½"	8,000	12	NA	Do
S1	4-8-4	20	Do	1940	62,400	137.5	445.5	34.4	79"	2	25	32	290	20' 6"	97' 2½"	115' 5 9/16"	18,000	46	NA	Do
A4	0-6-6-0	18	Do	1950	45,000	107.0	107.0	28.0	40"	8	8	10	NA	11' 4"	41' 1"	56' 6"	200	NA	800	Diesel-electric
B6	0-4-4-0	22	Besler Co	1955	48,000	80.8	80.8	21.2	40"	8	6	8	NA	6' 10"	33' 6"	49' 2"	135	NA	750	Do
D2	0-4-0	16	GE	1953	15,000	25.0	25.0	12.5	33"	6	5	6	NA	NA	6' 1"	18' 2"	11	NA	75	Do
E4	0-4-0	29	Lima	1956	15,000	25.0	25.0	12.5	28"	6	5	6	NA	6' 1"	6' 1"	18' 2"	14	NA	75	Diesel-mech

ADDITIONAL REMARKS

See attached sheets for further details.

DATE: 1 April 1969

TYPED NAME AND GRADE: J. T. MILLER, Major, TC, Adjutant

SIGNATURE: J. T. Miller

Figure I–17. Locomotive characteristics and inventory.

FREIGHT EQUIPMENT CHARACTERISTICS AND INVENTORY - TRANSPORTATION INTELLIGENCE

NAME OF FACILITY: Shiloh National Railways

PREPARED BY: H. B. COATS, Lt Colonel, TC, S2

HEADQUARTERS: 799th Transportation Railway Group

PAGE NUMBER: 2 | NUMBER OF PAGES: 3

KEY: NA - Not Applicable

TYPE OF EQUIPMENT (Box, Gondola, Flat, etc.)	CLASS OR SERIES (Letter or Number Designation)	NUMBER IN SERVICE	YEAR BUILT	CAPACITY (Short Tons)	TARE WEIGHT	INSIDE DIMENSIONS (Ft. and In.)			OUTSIDE DIMENSIONS (Ft. and In.)			FLOOR HEIGHT ABOVE RAIL (Ft. & In.)	NUMBER OF AXLES	TYPE OF BRAKES	COUPLER		LENGTH BETWEEN BUFFERS (Ft. & In.)
						LENGTH	WIDTH	HEIGHT	LENGTH	WIDTH	HEIGHT				TYPE	HEIGHT ABOVE RAIL	
Box, steel*	XM	2584	1925	50	22 STON	40' 6"	9' 2"	10' 6"	42' 3"	10' 8"	15' 2"	3' 5 3/4"	4	Air	AAR standard E.	2' 10½"	NA
Hopper, steel	HT	3157	1930	70	25 STON	40' 2"	9' 6"	NA	42' 0"	11' 3"	11' 4"	3' 5½"	4	Air	Do	2' 10½"	NA
Gondola, steel	GB	1600	1932	70	20 STON	46' 0"	9' 6"	3' 0"	48' 7"	10' 4"	7' 4"	3' 5 1/8"	4	Air	Do	2' 10½"	NA
Flat, steel	FM	602	1934	95	35 STON	30' 0"	9' 0"	NA	30' 0"	10' 0"	7' 1"	3' 5 1/8"	4	Air	Do	2' 10½"	NA

REMARKS

*Boxcar door opening: 8' wide and 9' 10" high

DATE: 26 August 1969

TYPED NAME AND GRADE: M. L. KEYES, Major, TC, Adjutant

SIGNATURE: M. L. Keyes

Figure I-18. Freight equipment characteristics and inventory.

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

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